

Ministry of Agriculture of the Republic of Kazakhstan
Kazakh Agrotechnical Research University named after S.Seifullin

APPROVE
«S.Seifullin Kazakh Agrotechnical
Research University» NJSC
Chairman of the Board-Rector
_____ Tireuov K.M.

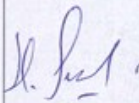
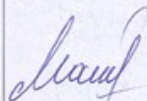
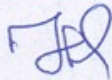
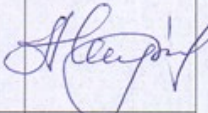
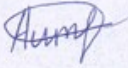
«__» ____ y., №__ protocol

EDUCATIONAL PROGRAM

6B06201 – «Telecommunication networks and systems»
(name of the program)

The code and classification of the field of education:	6B06 Information and communication technologies
The code and classification of training areas:	6B062 Telecommunications
The code in the International Standard Classification of Education:	0714
Degree/qualification awarded: Bachelor / Specialist/Master/Doctor	Bachelor's Degree in Information and Communication Technology

Academic Committee:

№	Full name	Academic degree, academic title	Position at work	Place of work	Signature
1	Dunayev P.A.	PhD, Associate Professor	Head of the Department of Radio Engineering, Electronics and Telecommunications	«S.Seifullin KATRU» NJSC	
2	Manbetova Zh.D.	PhD	Acting Associate Professor - Senior Lecturer, Department of Radio Engineering, Electronics and Telecommunications	«S.Seifullin KATRU» NJSC	
3	Nabiyev N.K.	candidate of technical sciences	Senior Lecturer, Department of Radio Engineering, Electronics and Telecommunications	«S.Seifullin KATRU» NJSC	
4	Mirmanov A.B.		Associate Professor, Department of Radio Engineering, Electronics and Telecommunications	«S.Seifullin KATRU» NJSC	
5	Aitkulov N.S.		Master's degree graduate, Department of Radio Engineering, Electronics and Telecommunications	«S.Seifullin KATRU» NJSC	
6	Kenzhebulatov D.B.		3rd year student, group 08-059-21-13, department "Radio engineering, electronics and telecommunications"	«S.Seifullin KATRU» NJSC	

Agreed with representatives of employers:

№	Full name	Position at work	Place of work	Signature
1	Tukushev N.B.	Chief Project Manager	DCB Business Development Services – Corporate Business Division – branch of «Kazakhtelecom» JSC	
2	Myalo M.V.	Head of the Central Service of Dispatch and Technological Control Facilities (CSDTCF)	«Akmola Distribution Electricity Grid Company» JSC	

The Academic Committee was approved by the order of the Chairman of the Board of «S.Seifullin KATRU» NJSC

«17» 12 2024 y., №435-H protocol

The Academic Committee was approved by the order of the Chairman of the Board-Rector of «S.Seifullin KATRU» NJSC:

«17» 12. 2024 y., № 435-H protocol

Educational program 6B06201 – «Telecommunication networks and systems»
(code and name of the program)

Reviewed on:

at the meeting of the department «Radio engineering, electronics and telecommunications»

«__» _____ 20__ y., №__ protocol

at the meeting of the Faculty Council on Academic Quality

«__» _____ 20__ y., №__ protocol

at the meeting of the Academic Council of the University

«__» _____ 20__ y., №__ protocol

Date of update «__» _____ 20__ y.

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1 Passport of the educational program

1.1 Objective of the educational program

Professional training of highly qualified specialists with a competitive level of knowledge in accordance with the level of development of technology and engineering in the field of telecommunications systems, networks and devices, skills and professional abilities in the field of relevant areas, with the necessary professional and personal competencies sufficient for successful operation at enterprises in the republic and beyond.

The resulting learning outcomes:

LO1 To demonstrate knowledge of basics of design and installation, to be able to operate electronic and info-telecommunications devices and systems, to know the methods of calculation of electric circuits.

LO2 To possess deep knowledge in the field of natural-mathematical sciences and history.

LO3 To possess profound knowledge of information and computer technologies, the basics and elemental base of telecommunications used in professional activities.

LO4 To possess a deep level of knowledge in the field of analog and digital electronic technologies, to have experience in circuit modeling, to demonstrate knowledge in the field of microprocessor systems and to possess the skills of programming microcontrollers.

LO5 To be able to carry out calculations for the design of systems and networks of telecommunications, to use modern software packages of computer programs for calculations, modeling and automation of design of radio electronic devices and systems of telecommunications.

LO6 To possess knowledge of the theory of electrical and digital communications, about the methods, principles of operation of devices for processing and converting data transmission signals.

LO7 Possess knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate wireless and wired data transmission networks, IoT system management at the physical, network and application level.

LO8 Apply theoretical knowledge in solving problems of designing radio electronic and infocommunication systems.

LO9 To demonstrate knowledge of the modern technology, requirements of standardization, metrological support and life safety in the development and operation of radio equipment and information and communication systems.

LO10 To know the state language and one foreign language for providing and documenting of information, to be able to use the normative and legal documentation, typical for the field of information and communication technologies and communication systems, to be ready to read the project and working technical documentation.

LO11 To develop students' competencies in economics, law and innovative entrepreneurship, the basics of anti-corruption culture, ecology, the basics of life safety and the Sustainable Development Goals (SDGs), as well as the basics of artificial intelligence and scientific research in the field of telecommunications, with an emphasis on the development of inclusive thinking, respect for diversity and the principles of equal opportunities for all.

Regulatory framework

- Constitution of the Republic of Kazakhstan.
- Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III “On Education” (as amended and supplemented as of 01.05.2023).
- Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 28916 “On approval of state compulsory standards of higher and postgraduate education”.
- National Qualifications Framework of 16.03.2016.
- Sectoral qualifications framework “TELECOMMUNICATIONS” No. 102-XT dated July 29, 2019.

• Atlas of new professions of the Republic of Kazakhstan (<https://atlasbt.enbek.kz/industry/4>).

• Professional standard:

1. Development IoT systems (05.12.2022 y.),
<https://career.enbek.kz/ru/professionalstandart/584>.

Production unit

Department of Radio Engineering, Electronics and Telecommunications

2 General characteristics of the educational program

Nowadays it is difficult to imagine a field of science and technology where the achievements of telecommunication networks and systems would not be used. These achievements are not only radio and television broadcasting, but also mobile, space and satellite communications, computer radio electronics, smart home based on wireless technologies, the Internet of things, control systems for land, sea and air transport, etc. There is a rapid development of telemetry systems, ground, air and space-based radar systems and communication systems based on digital technologies. Graduates of the educational program "Telecommunication networks and systems" new level will have competitive advantages over other technical specialties.

The educational program "Telecommunication Networks and Systems" has been developed in accordance with the National Qualifications Framework and is aligned with the Dublin Descriptors and the European Qualifications Framework. The educational program is designed on the basis of a modular system of studying disciplines and contains modules, forming general cultural and professional competencies.

The educational program "Telecommunication Networks and Systems" includes the study of the following cycles:

- theoretical training in cycles of general education, basic and specialized disciplines,
- additional types of training: military training, etc.;
- final state certification in the form of passing a state exam in the specialty and a comprehensive exam/preparation and defense of a bachelor's thesis.

Standard period for mastering the educational program for full-time education is 4 years. The complexity of mastering the educational program "Telecommunication Networks and Systems" by a student, indicated in credits for the entire period of study in accordance with the State Educational Standard of the Republic of Kazakhstan in the field of training 6B062 Telecommunications, including all types of classroom and independent work of the student and practice, is 240 credits.

3 Competency model (portrait) of a graduate

3.1 Areas of professional activity

The sphere of professional activity is the field of science and technology, which includes a set of technologies, means, methods and techniques of human activity aimed at creating conditions for the exchange of information at a distance.

3.2 Types of professional activity

A graduate of the educational program "Radio Engineering and Electronics" can perform the following types of professional activities:

- production and technological;
- service and operational;
- organizational and managerial;
- installation and commissioning;
- calculation and design;
- experimental research.

3.3 General educational competencies

- have basic knowledge in the field of natural sciences (social sciences, humanities), which contribute to the formation of a highly educated individual with a broad outlook and culture of thinking;
- know the social and ethical values based on public opinion, traditions, customs, social norms and be guided by them in their professional activities; know the traditions and culture of the peoples of Kazakhstan; knowledge in the field of forming a healthy lifestyle;
- be able to apply the fundamentals of the legal system and legislation of Kazakhstan;
- be able to navigate adequately in various social situations;
- be able to independently apply means, methodically correct methods of physical education and health promotion;
- comply with business ethics standards, possess ethical and legal standards of conduct;
- be tolerant of the traditions and culture of other peoples of the world;
- know the trends of social development of society;
- possess the ability to live effectively and function successfully in social interaction: change and adapt to discussion and reaching agreement with others;
- maintain relationships in the professional community, bear social responsibility for the results of their professional work;
- have the readiness to achieve the proper level of physical fitness to ensure full social and professional activity.

3.4 Basic competencies

In accordance with general personal knowledge, skills and abilities, and competencies, a bachelor must:

- develop and apply mathematical methods of thinking in their professional activities; is able to use the basics of natural science knowledge and methodology to identify production problems and solve professional tasks.
- possess basic knowledge in the field of economic and management disciplines (sciences); have the ability to engage in self-study, be able to effectively manage time and information; strive for professional and personal growth.

- be prepared to create conditions for the development of the communications infrastructure of the Republic of Kazakhstan, ensuring its integration with international communications networks; readiness to facilitate the implementation of advanced technologies and standards;
- possess the skills to acquire new knowledge necessary for everyday professional activities and continuing education in a Master's degree program;
- have skills in handling modern technology, be able to use information technologies in the field of professional activity;
- strive for professional and personal growth;
- have the ability to conduct a holistic and systematic analysis of the problems of modern life in society and the environment, the ability to diagnose the production situation, and make appropriate decisions;
- develop management decisions.

3.5 Professional competencies

- know the operating principles, technical characteristics, and features of the telecommunication systems and networks used; know the necessary measures to ensure life safety and environmental protection during the design, construction, and operation of telecommunication systems and networks;
- be able to develop the structure of telecommunication networks, design telecommunication systems and networks; perform calculations related to the selection of values for network element parameters, optimization of these parameters and operating modes using computer technology and special programs; be able to analyze the reliability of telecommunication network and system circuits; be able to diagnose electronic devices of telecommunication systems; be able to select the necessary electronic components (standard replacement elements) when eliminating damage; have skills in operating the technical objects (means and systems) being studied, have skills in working in equipment with electronic components and computer systems and networks;
- be prepared to design and operate telecommunication systems and networks, including design, construction, installation and operation of cable communication systems, computer networks, methods of conducting theoretical and experimental research in the field of communication technology;
- be able to analyze the structure and capabilities of the main systems for transmitting and converting information about objects and systems, have the skills to develop and design equipment and devices for transmitting, receiving and distributing information using modern element bases;
- be ready to operate mobile communication systems; ready to operate switching systems and communication networks; ready to operate computer networks, diagnose and evaluate the state of telecommunication systems using the necessary methods and means of control and analysis.

4. Base for professional practice

The educational practice involves studying standard packages of applied programs for solving practical problems; using basic methods of processing experimental data, checking, adjusting and adjusting equipment and setting up software, acquiring skills in working with measuring instruments and methods of processing the results of experimental studies.

Educational practice is carried out in the first year in the department's laboratories.

Industrial practice aims to systematize, expand and consolidate professional knowledge, develop students' skills in conducting independent scientific work, research and experimentation, as well as create a theoretical and experimental basis for the high-quality completion of the final qualifying (diploma) work and its defense.

It is envisaged that students will undergo educational, industrial, and pre-graduation practice.

Places for internship may include telecommunications operators, research and development organizations, industrial enterprises and universities equipped with modern telecommunications equipment, measuring and computer technology.

The internship is conducted at the following major enterprises in the field of information and telecommunication technologies and electronics in the Republic of Kazakhstan:

1. JSC "Nursultan Nazarbayev International Airport";
2. Branches of JSC "Transtelecom", RK;
3. Public Organization "Kazakhstan Federation of Radio Sports and Amateur Radio" Astana city;
4. TOO "Ulttyk Telecom", Astana;
5. Branches of JSC "Kazakhtelecom", RK;
6. JSC Astana-Regional Electric Grid Company, Astana city. JSC "NC "Kazakhstan" Temir Zholy", Astana;
8. LLP "Digital system service", Astana;
9. LLP "Halyk Telecom" Astana;
10. Sputnik Service 2007 LLP, Astana;
11. JSC NK KTZ GCUS, Astana;
12. Branch of JSC "Industrial Construction Telephone Company" Bitelecom - Akmola PMC communications;
13. Club Robotek, Astana;
14. JSC Energoinform, Astana;
15. LLP Central Asia Telecom, Astana;
16. LLP "MBit", Astana;
17. RTRK "Kazakhstan", Astana;
18. LLP "KazMedia Center", Astana;
19. "Allem" Engineering Company LLP, Astana;
20. LLP "Astana Electrotechnical Plant", Astana;
21. JSC "Astel", Astana;
22. National Security Committee OF THE Republic OF Kazakhstan.

The specified organizations and enterprises as a practice base include most of the objects of professional activity for the future specialist.

Internships can be conducted in the following divisions of these enterprises:

- areas of operation of telecommunication systems;
- areas for adjustment and assembly of devices, means and systems of communication and television and radio broadcasting;
- sections for product control and computer methods for measuring parameters, troubleshooting of communication equipment;
- control and measuring departments or laboratories for testing communication equipment and systems;
- development departments and design departments.

When assigning students to internships, preference is given to enterprises offering jobs for students after graduation and to enterprises with which contractual or business relations have been established.

5 Structure of the educational program

No.	Name of cycles and disciplines	Total labor intensity	
		in academic hours	in academic credits
1	2	3	4
1	Cycle of general education disciplines (GED)	1680	56
1)	Required component	1530	51
	Foreign language	300	10
	Kazakh (Russian) language	300	10
	Information and Communication Technologies (in English)	150	5
	History of Kazakhstan	150	5
	Physical culture	240	8
	Political Science and Sociology	120	4
	Cultural studies and psychology	120	4
	Philosophy	150	5
2)	University component	150	5
	Economics, law and innovative entrepreneurship	150	5
2	Cycle of basic disciplines (BD)	2790	93
1)	University component	2700	90
	Mathematics I	150	5
	Physics	150	5
	Mathematics II	150	5
	Engineering Mathematics	120	4
	Algorithmization and programming in high-level languages	90	3
	Educational practice	60	2
	Industrial practice	360	12
	Electrical Circuit Theory 1	150	5
	Electrical Circuit Theory 2	150	5
	Digital devices and microprocessor technology 1	150	5
	Electronics and circuitry 1	150	5
	Fundamentals of Electronic and Measuring Technology	150	5
	Fundamentals of Radio Engineering, Electronics and Telecommunications	120	4
	Electromagnetic fields and waves	150	5
	Electronics and circuitry 2	150	5
	Theory of electrical communication	150	5
	Digital devices and microprocessor technology 2	150	5
	Digital signal processing	150	5
	Digital Communication Theory	150	5
	Pre-graduation practice	150	5
2)	Component of choice	90	3
	Basics of anti-corruption culture	90	3
	Ecology, fundamentals of life safety and the SDGs		
	Artificial intelligence basics		
	Radiophysics		

3	Cycle of major disciplines (MD)	2490	83
1)	University component	1800	60
	Antenna-feeder devices and radio wave propagation	150	5
	Programming of telecommunication and radio-electronic systems	150	5
	Software engineering	150	5
	Television and radio broadcasting	150	5
	Data transfer protocols	150	5
	Packet and hybrid switching networks	150	5
	Transport Network Technologies	150	5
	Teletraffic theory	120	4
	Design and operation of telecommunication networks	150	5
	Safety and control in radio engineering and communications	90	3
	Fundamentals of scientific research in the field of telecommunications training	90	3
2)	Component of choice	690	23
	Cable communication systems	150	5
	Communication guide systems	150	5
	Wireless communication technologies	150	5
	Fundamentals of Mobile Communication Systems	150	5
	Satellite and radio relay communication systems	150	5
	Radio transmitting and receiving devices	150	5
	Reliability of television and radio electronic equipment	90	3
	Assessment of fault tolerance of electronic devices	90	3
	Internet of Things	150	5
	Cloud telecommunications technologies	150	5
4	Additional types of education (ATE)		
1)	Elective component (military training and other types of educational activities)		
5	Final certification	240	8
1)	Writing and defending a thesis (project) or preparing and passing a comprehensive exam	240	8
	Total	7200	240

Appendix 1 Academic Calendar

Appendix 1 to the Academic Calendar

Approved by the Academic Council of the NJSC "S.Seifullin KATIUS", Protocol №14 of 27.03.2025 y.

Schedule of the educational process for the 2025-2026 academic year for the educational program Energy faculty

[illegible]

Conventions

Presentation
week
FW

Theoretical
training

Enrollment in disciplines	TD
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Examina
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☐ Passing

Holidays

INT

Summer
semester
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Final
examin
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Educational
practices

Industrial
practice
IP

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September 1
December 16
January 1-2
August 30
October 25

Knowledge day
Independence Day of the RK
New year
New yaer
Renublic Day

March 8	International Women's Day
March 21-23	Holiday "Nauryz"
May 1	Day of Unity of the Nations of Kazakhstan
May 7	Defender of the Fatherland day
May 9	Victory Day
July 6	Capital Day

registration for disciplines

Considered at the meeting
of Academic Council
of the University
Protocol No. 9
3.06.2025

The Ministry of Agriculture of the Republic of Kazakhstan
NC JSC "S. Seifullin Kazakh Agrotechnical Research University"



CURRICULUM
for 2025-2029 academic year
For the modular education program "Telecommunication networks and systems"
by the specialty group of educational programmes B059 - Communications and communication technologies
Degree: Bachelor
Form of education: Full-time (bachelor 4 years) semester
Entry year: 01-09-2025

Module code	Module name	Discipline cycle	Discipline component	Code of subject	Subject name	Academic credits	Academic study period	Control in the academic period					Number of hours					Distribution of credits per academic period																							
								Exams	Differentials	Test	Term paper	Total	Lectures	Laboratory	Practical training	Classroom work	Studio lessons	Practic e	Independent work	Independent work	Independent work	Number of weeks in the academic period																			
																						1 course								2 course				3 course				4 course			
																						1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8				
																		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15								
General modules																																									
1	Socio - political knowledge	GER	CG	IKT 1100	Information and communication technologies	5	1	1				5/150	15	30.0						20	85	5.0																			
2		GER	CG	PS 1102	Political science and sociology	4	1	1				4/120	15		30				16	59	4.0																				
3		GER	CG	KP 1103	Cultural studies and psychology	4	2	2				4/120	15		30				16	59		4.0																			
4		GER	CG	IK 1112	History of Kazakhstan	5	2	2				5/150	15		30				20	85		5.0																			
5		GER	CG	FI 2100	Philosophy	5	3	3				5/150	15		30				20	85																					
6	Languages	GER	UC	EP 2113	Economics, Law and Innovation Entrepreneurship	5	3	3				5/150	15		30				20	85																					
7		GER	CG	KRYa 1100	Kazakh (russian) language	5	1	1				5/150			45				20	85	5.0																				
8		GER	CG	IYa 1100	Foreign language	5	1	1				5/150			45				20	85	5.0																				
9		GER	CG	IYa 1100	Foreign language	5	1	1				5/150			45				20	85	5.0																				
10		GER	CG	KRYa 1100	Kazakh (russian) language	5	2	2				5/150			45				20	85		5.0																			
11	Physical education	GER	CG	FK 1101	Physical education	2	1	1				2/60			15				8	37	2.0																				
12		GER	CG	FK 1106	Physical education	2	2	2				2/60			15				8	37		2.0																			
13		GER	CG	FK 2108	Physical education	2	3	3				2/60			15				8	37			2.0																		
14		GER	CG	FK 2109	Physical education	2	4	4				2/60			15				8	37				2.0																	
15		BS	UC	FIz 1202	Physics	5	1	1				5/150	15	15.0	15				20	85	5.0																				
16	Mathematics and physics	BS	UC	M 1202	Mathematics I	5	1	1				5/150	15		30				20	85	5.0																				
17		BS	UC	MI 1202	Mathematics II	5	2	2				5/150	15		30				20	85		5.0																			
18		BS	UC	APYAUVU 1202	Algorithmization and High-level Languages Programming	5	2	2				5/150	15		30				20	85		5.0																			
19		BS	UC	IM 2210	Engineering mathematics	4	3	3				4/120	15	15.0	15				12	48		3.0																			
20		BS	UC	UP 2221	Educational practice	2	3	3				2/60			30				60	16	59																				
21	Professional practice	BS	UC	PP 3222	Internship	5	5	5				5/150							150																						
22		BS	UC	PP 4223	Internship	3	7	7				3/90							90																						
23		BS	UC	PP 4224	Internship	4	8	8				4/120							120																						
24		BS	UC	PP 4225	Pre diploma practice	5	8	8				5/150							150																						
Modules of specialty education program																																									
25	Telecommunications	BS	UC	ORET 2216	Basic concepts of radio engineering, electronics and telecommunications 1	4	3	3				4/120	15	15.0	15				16	59																					
26		BS	ES	EOBZhC 2229	Ecology, life safety principles and SDG							3/90																													
27		BS	ES	OII 2228	Artificial intelligence basics							3/90																													
28		BS	ES	OAK 2227	Basics of anti-corruption culture	3	3	3				3/90			15				12	48																					
29		BS	ES	Rad 2226	Radioelectronics							3/90																													
30		BS	UC	TCS 3214	Digital communications theory	5	6	6				5/150	15	15.0	15				20	85																					
31		BS	UC	COS 3220	Digital signal processing	5	6	6				5/150	15	15.0	15				20	85																					
32		AS	UC	ONIPNT 2223	Fundamentals of scientific research in the field of telecommunications training	3	4	4				3/90	15		15				12	48																					
33		AS	UC	AFURR 2317	Aerial-feeder devices and radio waves propagation	5	4	4				5/150	15	15.0	15				20	85																					
34		AS	UC	PTRS 3318	Programming of telecommunication and radio electronic systems	5	5	5				5/150	15	15.0	15				20	85																					
35		AS	UC	TES 3301	Electric communication theory	5	5	5				5/150	15	15.0	15				20	85																					
36		AS	ES	NSS 3312	Directing systems of communication	5	5	5				5/150	15	15.0	15				20	85																					
37		AS	ES	KSS 3312	Cable communication systems	5	5	5				5/150	15	15.0	15				20	85																					
38		AS	ES	TBS 3310	Technology of wireless connection	5	6	6				5/150	15	15.0	15				20	85																					
39		AS	ES	OSMS 3313	Basics of mobile communication systems	5	7	7				5/150	15	15.0	15				20	85																					
40		AS	UC	SPGK 4301	Packet and hybrid switching networks	5	7	7				5/150	15	15.0	15				20	85																					
41		AS	UC	TTSS 4301	Technologies of transport communication networks	5	7	7				5/150	15	15.0	15				20	85																					
42		AS	UC	TI 4301	Teletraffic theory	4	7	7				4/120	15		30				16	59																					
43		AS	UC	PPD 4321	Data transfer protocols	5	7	7				5/150	15	30.0					20	85																					
44		AS	ES	SRSS 4309	Satellite and radio relay communication systems	5	7	7				5/150	15	15.0	15				20	85																					
45		AS	ES	RRU 4314	Radio transmitting and radio receiving devices	5	7	7				5/150	15	15.0	15				20	85																					
46		AS	ES	NFA 4305	Reliability of telecommunication equipment	3	7	7				3/90	15		15				12	48																					
47		AS	UC	COBU 4315	Assessment of fault tolerance of electronic devices	3	7	7				3/90	15		15				12	48																					
48		AS	UC	PETSS 4301	Design and operation of telecommunication networks	5	8	8				5/150	15	15.0	15				20	85																					
49		AS	ES	OTT 4316	Cloud technologies of telecommunications	5	8	8				5/150	15	15.0	15				20	85																					
50		AS	ES	IV 4306	Internet of Things							5/150																													

Director of Department of Academic Affairs
Deputy Director of the Department of Academic Affairs
Dean of the faculty
Head of the Department

Zhurgenov Zhakenbay Sarsenbayevich
Nurgaliyeva Almagul Shaymuratovna
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Appendix 3 Description of disciplines of the GED cycle

Appendix 3 Description of disciplines of the GED cycle														
№	Name of discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)										
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11
Cycle of general education disciplines														
Required component /University component / Component of choice														
1	Foreign language	The course program is designed for the volume of teaching - 300 hours, of which: 90 hours - classroom work and 180 hours - independent work. The course ends with a comprehensive exam. The course is designed for 3 trimesters. As a result of mastering the program, the student, depending on the level of training, reaches the level B1/) or B2 at the time of completion of the course.	10										+	
2	Kazakh (Russian) language	Language and his basic functions. Speech: kinds and forms of speech.Functionally-semantic types of speech. Functional styles of speech. General description of functional styles of speech. Common concept about scientific style of speech. Features of scientific style at lexical, morphological, syntactic level. Text as leading unit of verbal communication. segmentation of text.Theme of text. Structure and sense of text. Communicative tasks of text.A role of suggestion is in text. function of suggestion. Progression of text as increase of his volume and information content.Compression as basic type of processing of scientific text. A plan and his drafting are in a scientific sphere. Types of plans. scientific text. Composition-semantic structure of scientific text. Summarizing of scientific text. Annotating of scientific texts. Types of lemmatas. Reviewing of scientific texts. Types of reports. Criticizing of scientific text. Structure of scientific review. Review about the advanced study.	10										+	
3	Information and communication technologies	The discipline covers the following topics: Review of computer systems. Evolution of computer systems. Architecture and components of computer systems. Data representation in computer systems. Representation of numbers and consequences. Types of the software, purpose and characteristic. Basic concepts of OS.	5	+		+					+			

		Classification of operating systems, including for mobile devices. Classification of desktop applications. Work with applications.												
4	History of Kazakhstan	The history of Kazakhstan consists of 5 thematic blocks: Ancient people and the formation of a nomadic civilization, Turkic civilization and the Great Steppe, Kazakhstan in modern times (XVIII - early XX centuries), Kazakhstan as part of the Soviet administrative-command system, Kazakhstan in the world community (1991-2022).	5		+									
5	Physical Culture	The formation of positive attitude, interest and need for physical education and sports. The improving the physical health of students on the basis of increasing the arsenal of motor abilities, professional-applied and methodical readiness. Preparation and participation in mass sports and recreational events and competitions in sports, with broad-based participation of students in the active physical culture. The Comprehensive use of physical culture and sports as a general physical training. Improving the level of physical and functional status. Preventive use of physical training for health purposes. The students gain additional, necessary knowledge on the basics of psychological, pedagogical, medical and biological control according to the method and organization of independent exercise and "lifelong" sports.	8											
6	Political Science and Sociology	Sociology in understanding the social world. Introduction to the theory of sociology. Sociological research. Social structure and stratification of society. Socialization and identity. Social change: the latest sociological debate. Political science as a science and academic discipline. The main stages of the formation and development of political science. Politics in the system of public life. Political power: the essence and mechanism of implementation. World politics and modern international relations.	4		+									+
7	Cultural studies and psychology	Formation of students understanding of culture as the highest human value, to facilities the development of cultural needs for independent assimilation of cultural values, to reveal the essence of the main problems of modern cultural studies and the creation of a holistic view of the psyche, personality and the creative nature of the human psyche, the ability to work in a team. Training in the skills of socio-psychological analysis and resolution of specific professional situations.	4		+									+
8	Philosophy	The emergence and development of philosophy. Basics of philosophical understanding of the world. Consciousness, soul and language. Being. Ontology and metaphysics. Human philosophy	5		+									+

		and value world. «Máńgilik El» and «Rýhanı jańǵyrý» - a new philosophy in Kazakhsta.												
9	Economics, Law and Innovation Entrepreneurship	The discipline is aimed at developing a systematic understanding of the key aspects of entrepreneurship, taking into account economic, legal and financial factors. The course covers modern approaches to business organization and management, legal foundations of entrepreneurship, as well as financial instruments necessary for sustainable development of enterprises.	5											+

Appendix 4 Description of BD disciplines

№	Name of discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)										
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11
Cycle of basic disciplines														
University component / Component of choice														
1	Mathematics I	Linear algebra, Analytical geometry on the plane, Vector algebra, Analytical geometry in space, Theory of limits.	5		+									
2	Algorithmization and High-level Languages Programming	Introduction to programming languages. The life cycle of the program. Formulation and specification of the program. Basic concepts of algorithmization. Programming in a high-level language. Representation of the main control structures of programming. Methods of designing programs. Program approvals. Methods of program verification. Modular program. Procedures and functions. Arrays. Features of programming in integrated environments. Debugging and testing programs.	3			+								
3	Physics	The discipline studies the basic physical phenomena, fundamental laws and concepts, as well as methods of physical research. Considers techniques and methods for solving typical problems from various fields of physics, introduces modern scientific equipment, forms the skills of conducting an experiment, the ability to highlight specific physical content in applied problems of a future specialty.	5		+					+				
4	Mathematics II	Differential calculus of one variable, Integral calculus of one variable, Definite integral, Differential calculus of functions of several variables.	5		+									
5	Educational practice	Reinforcement of knowledge in the disciplines of General professional and special training, formation of skills of using the scientific and methodological apparatus of these disciplines, obtained during the theoretical learning, the acquisition of practical vocational skills needed for independent work in major	2	+										

		areas of activity of bachelor by the profile of the provisioning.												
6	Engineering mathematics	General information of mathematical description and modeling of various real phenomena and processes. combined disciplines combining elements of physics, mathematics, computer methods of calculation are focused on the application of established methods for the design and analysis of engineering solutions in the field of mechanical engineering.	4		+									
7	Theory of electric chains 1	Methods for calculating of DC electrical circuits. Balance of power. Computersimulation of electrical circuits. Balance of power in circuits with harmonic effects. Resonance in electrical circuits. Frequency characteristics of the parallel circuit. Bandwidth. Methods for calculating of inductively coupled circuits. Decomposition on Fourier series. Calculation of circuits with periodic non-sinusoidal effects. Four-poles. Electric filters.	5	+										
8	Principles of electronic and measurement technology	Electrical conductivity of semiconductors. Electron-hole transition. Semiconductor devices. Basics of metrology. Measurement as an object of metrology. Types and methods of measurement. Basic measurement tools. Classification of measurement errors. Measuring transducers. Analog measuring instruments. Digital devices. Microprocessor devices. Fundamentals of standardization. Goals, significance and objectives of standardization. International standardization. Basics of certification. Varieties of certification systems. State certification system of the Republic of Kazakhstan.	5				+					+		
9	Basic concepts of radio engineering, electronics and telecommunications	Fundamentals of radio engineering, electronics and telecommunications. Purpose of functional units of radio engineering systems, OSI network model, purpose, operating conditions. Data transmission via Internet and telephone network, ATS and its structural structure, digital network with service integration, intelligent network, NGN main trends in the development of telecommunication networks systems.	4			+				+				

10	Electromagnetic fields and waves	The basic laws of electrodynamics. Wave equation for the electromagnetic field. Plane electromagnetic waves in homogeneous and isotropic media. Electromagnetic plane waves in frequency dispersion media. Wave phenomena at the interface of the media. Guided electromagnetic waves. Rectangular metal waveguides. Round metal waveguides. Cavity resonators.	5							+				
11	Theory of electric chains 2	Transients in electrical circuits, switching laws and initial conditions; transient conditions, transients in RL-RC - and RLC circuits of constant and harmonic voltage; enforced and free mode. The classic method of calculating transients. Operator method for calculating transients. Laplace transform. Calculation of transients at arbitrary input effects using the Duhamel integral. Calculation of transient processes with impulse effects.	5	+										
12	Electronics and circuit engineering 1	The structure and principle of operation of semiconductor devices. Varieties and structure of power sources. Parametric and compensation regulators of voltage. Dependent and autonomous voltage inverters. Optoelectronic devices. Circuitry amplifying devices. Feedback amplifiers. The purpose of feedback and how to organize them.	5				+	+						
13	Production practice	Professional practice is a compulsory section of the educational program and is a type of educational activity focused on the professional and practical training of students. The purpose of professional practice is the systematization, synthesis and deepening of theoretical knowledge and skills acquired by students during the development of the educational program, the formation of professional skills and professional experience of the bachelor of students.	12			+	+	+			+			
14	Digital devices and microprocessor technology 1	Introduction to Digital Electronics (DE). Number Systems in DE. Basic logic elements. Boolean Algebra. Encryptors and decoders. Multiplexers and demultiplexers. RS, D, JK and T triggers. Sequential and countdown action of counters. Shift registers: sequential, parallel and universal. Arithmetic devices. Summators and subtractors. Binary subtraction and summation. Binary	5		+		+							

		multiplication, binary division.												
15	Electronics and circuit engineering 2	Impulse devices. Algebra of logic. Logical messages, logical operations, the simplest logical elements. Basic logic elements. Types of logic chips. The main parameters of the IC. Combinational logic circuits. CLC varieties. Sequence integral CLC. Pulse distributors. Counters with an arbitrary count factor. Pulse counters. Digital to Analog Converters (D / A). Analog-to-Digital Converters (ADC).	5				+	+						
16	Electric communication theory	General information about ECT. Coding, modulation, demodulation, decoding. Interference, noise, distortion in communication channels. Bandwidth communication channels. The theorem and Kotelnikov series. Energy spectra of signals. White noise. Analytical signal. Correlation function narrowband of random process. Amplitude modulation. Angle modulation. Circuits of Modem. The temporal and spectral representation of signals with pulse modulation. Pulse code modulation.	5					+	+	+				
17	Digital devices and microprocessor technology 2	Basic definitions in microprocessor systems. Classification MPS. Principles of von Neumann. Architecture of MPS. Memory in the MPS. Classification of MPS commands. The composition of commands MPS. Structure of MPS. MPS circuit outputs and the appointment of the main elements. MPS programming. Language ASSEMBLER. Basic concepts. Interruptions in the MPS and work with them. Stack in the MPS and work with it. Program model of MPS. Interfaces inputs outputs of MPS. The main stages of documenting MPS programs.	5		+		+							
18	Digital signal processing	Discrete signals. Discrete systems. Basics of digital filtering. Filtering random signals. Computational process and computational algorithms. Digital frequency filters. Linear phase digital filters. Deconvolution of signals. Deconvolution filters. Wavelet transform. Wavelet function. Kuranen-Loeve discrete transformation. Digital filter, optimal by the criterion of maximum signal-to-noise ratio. Special discrete random processes. Special	5		+			+	+					

		discrete random processes.												
19	Digital communications theory	Functional circuit and the main elements of a digital communication system. Compliance with the OSI model. Signal classification. Analysis of the communication channel. Interference and noise. Methods of recording a digital signal. Sign coding. Pulse modulation. S / N ratio. Basic principles of detecting and correcting errors. Hamming codes. Convolutional codes. Iterative and cascading codes. The concept of turbo coding. Scrambling Group and itemsynchronization. Systems with feed back.	5					+	+					
20	Pre-graduate practice	Application of knowledge gained in the development of the educational program in practice and preparation for writing a thesis.	5	+		+	+	+			+	+		
21	Basics of anti-corruption culture	The course forms a system of knowledge on combating corruption, and develops on this basis a civil position in relation to this phenomenon. The discipline studies the fundamentals of legislation; normative legal acts, moral and legal norms.	3											+
22	Ecology, life safety principles and SDG	The discipline studies the interrelation of environmental science with other sciences, the patterns of interaction between organisms and their habitat, the laws of development and existence of biogeocenoses as complexes of interacting living and inanimate components in various parts of the biosphere, the goals of sustainable development (namely, global problems of humanity and ways to solve them), issues of preserving human health and life in the technosphere, protection from hazards of man-made and natural origin and the creation of comfortable living conditions.	3											+
23	Artificial intelligence basics	AI principles, history, ethics, text processing, computer vision, decision-making systems, logic, planning, and utilizing platforms like GPT, IBM Watson, and Microsoft Azure AI for data analysis and process automation.	3											+

24	Radiophysics	Radiophysics. Correctly express physical ideas, apply the laws of physics to analyze and solve specific physical problems of radiophysics; use basic physical instruments, take measurements, process the results obtained and analyze them; use scientific, educational, methodological and reference literature. Skills of scientific analysis and forecasting of various phenomena and processes.	3		+					+				
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Appendix 5. Description of disciplines of the MD cycle

№	Name of discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)										
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11
Cycle of major disciplines														
University component / Component of choice														
1	Fundamentals of scientific research in the field of telecommunications training	Definition of the object and subject of research, formulation of goals and objectives, selection of research methods and stages, conducting research, analyzing results and drawing conclusions. Statistical processing of experimental data and elements of variance analysis.	3											+
2	Aerial-feeder devices and radio waves propagation	The theory of propagation of radio waves of various ranges. Calculation of coverage areas in radio and television broadcasting. Theory and calculation of the propagation of radio waves in urban environments and indoors. The influence of the atmosphere on the propagation of radio waves. The propagation of radio waves on the route of the Earth-Earth satellite. Calculation of radiation fields, long-range tropospheric, short-wave radio path. Fundamentals of the theory of antennas. Theory of vibrator, directorial, log-periodic parabolic antennas.	5				+			+				
3	Programming of telecommunications and radio electronic systems	Python programming language. Comparison Operators in Python. Advantages and disadvantages of the language. Data types. Equivalent to null None. Check for no. Basic modules. Operations on files and directories. High-level functions for creating and reading archived and compressed files. Request the size of the final output. Unittest module. Command line interface. Test detection. The organization of the test code. Checks for success. Subprocess module Fraction Modules, cmath, glob, functools, os.path. Python for the Web.	5		+		+				+			

4	Softwareengineering	Models and life cycle profiles. Processes of software life cycle of microprocessor and embedded systems. Project management software automation systems. The main processes of software engineering. General issues of software engineering processes. Methods and tools of software engineering. Formal and applied models of software engineering. Use of methodology in field of theory of system and analysis of systems in software engineering.	5		+		+				+			
5	Television and radio broadcasting	Converting an optical image into an electrical signal. Block scheme of the television system. Principles of building converters. Sensors of television signals and their characteristics. Color television systems. Colorimetric determination of color. Digital representation of image signals. Compression of digital television signals. MPEG-1,2,4 and MPEG-7 video compression: Digital modulation of video signals. Digital television broadcasting DVB: Broadcasting systems. Broadcasting in Long Wave, Middle Wave and HF bands. Digitalbroadcasting.	5						+	+				
6	Technologies of transport communication networks	Block diagram, nodes, hierarchies and standards of DST IKM HFC. Digital streams PDH, SDH. SDH equipment. Management and synchronization in SDH. DSP for different areas of telecommunications. Linear path DSP on EX. Optoelectronic components VOSPI. Optical linear path. Packing methods, fiber optic design. Models of optical transport networks.	5					+			+			
7	Data transfer protocols	The concept of the protocol and the protocol stack. Presentation of protocols by function. Organizations (IETF, IEEE, ISO, ITU-T) developing and regulating protocols. Basic Reference Model of Open Systems Interconnection - ISO / OSI. Levels, tasks and related protocols. Comparison of the OSI model and other models. The TCP / IP, IPX / SPX protocol family. Stacks of protocols NetBIOS / SMB, NovellNetWare, DECnet. Protocols X.25, FrameRelay, MPLS, FTP. Telephonyprotocols V5, VoIP.	5			+				+				
8	Teletraffic theory	Mathematical models of information distribution systems. The main tasks of teletraffic theory. Call flows. Duration of service. The flow of exemptions. Load. Characteristics of service quality.	4		+						+			

		Bandwidth switching systems. The method of statistical modeling in the problems of teletraffic theory. Lossy systems Erlang formula for a perfectly symmetric, incomplete scheme. The method of enlargement of the states of the beams in determining the characteristics of the control information.												
9	Packet and hybrid switching networks	Packet switching systems: composition, structure. Top levels of TCP / IP models. Organization of packet data transmission over copper, fiber-optic cables, over a wireless environment, hybrid switching. Channel level. LLS and MAS sublevels. Switches in local networks. Broadband packet switching. Main terabit switches / routers. The Basics of Broadband Networks: Virtual Channels VCI and Virtual Paths VPI.	5			+	+			+				
10	Design and operation of telecommunication networks	Innovative development of information and communication services, systems and networks of mobile communication, global network, personal Internet communications, digital transmission systems and secure communication systems of the Republic of Kazakhstan. Basic concepts, definitions and principles of building telecommunication networks. Topology and structure of building a telecommunication network. Features of the construction of secondary telecommunications networks. Construction of various paths by two given network nodes. NGN networks.	5					+			+		+	
11	Security and management in radio engineering and communications	The concept and principles of TMN (Telecommunication Management Network - Network management system of telecommunication operators). Means and technologies for ensuring information security of telecommunications networks and signals of radio engineering systems. Study of information security management processes of protected objects.	3							+		+		
12	Cable communication systems	Classification, frequency range and structural features of the guide telecommunications systems. Electrodynamics of the guiding systems. Primary and secondary transmission options. Theory of optical communication systems. Optical fibers, design features. Parameters of optical fiber and cable. Electromagnetic effects, corrosion in telecommunications cables. Design, installation and	5	+				+						

		operation of telecommunication CCS.												
13	Directing systems of communication	Classification, frequency range and structural elements, features of guiding systems in the infocommunication industry. Theory of guiding systems, application of principles of electrodynamics. Transmission of electromagnetic energy through guiding systems, primary and secondary transmission parameters. Theory of optical communication. Information about the optical fiber – the guiding system of the optical cable, types of construction. The main parameters of the optical fiber. The main parameters of the optical cable.	5	+				+						
14	Technology of wireless connection	Classification of wireless communications. Spectrum conversion methods using carrier frequency. Amplitude, frequency, two-phase phase shift keying. Coherent and incoherent detection. Multiposition phase and quadrature amplitude modulation. Multiple access. Spectrum spreading methods. Features of the transmission channel in wireless systems. Models of signal power loss calculation. The concept, components, principles and systems of the cellular network. Trunking systems. Cordless telephony. Standards IEEE 805.15. X., IEEE 802.15.4:, 802.11. LPWAN technology.	5						+	+				
15	Basics of mobile communication systems	Overview and classification of modern mobile radio communication systems. Organizational system of mobile radio communication systems. the composition and structural elements of the cellular communication system. The system of base stations. Features of radio wave propagation in mobile communication systems. Functioning of cellular mobile radio communication systems. Radio planning of cellular mobile radio communication systems.	5						+	+				
16	Satellite and radio relay communication systems	Features of propagation of radio waves in near-Earth space. Primary telecommunication signals and their characteristics. Satellite communication systems (SCS); basic principles of construction; orbit parameters; types of orbits. The main characteristics of the structure of space stations. Ground segment.	5					+	+	+				

		Block diagram of the earth station. VSAT systems. Energy calculation of satellite communication line. Electromagnetic compatibility. Overview of existing and prospective SCS. General principles of building RRL. Principles of construction of radio relay equipment. RRL design.												
17	Radiotransmitting and radioreceiving devices	Functional scheme of radio transmitting devices. External excitation generator. Digital modulation techniques in modern radio communications and radio access devices. The problem and the ways of its solution in terms of building a highly efficient and high-quality gain of multi-frequency power of OFDM signals. The main technical indicators and the structure of radio receivers. Frequency converters. General information about radio receivers. Schemes of construction. The main nodes of radio receivers.	5	+			+		+					
18	Reliability of teleradioelectronic equipment	The problem of evaluating the reliability of electronic equipment. Basic concepts of the theory of reliability of electronic equipment. The reliability of the element of technical systems REA. Mathematical apparatus of the theory of reliability REA. The concepts of failure and recovery elements of electronic equipment. Distribution functions of trouble-free operation of electronic equipment. Determination of the reliability of the technical system of electronic equipment for the reliability of its elements. Hardware redundancy. Factors determining the reliability of electronic equipment. Reliability of the system with the restoration of electronic equipment.	3			+						+		
19	Assessment of fault tolerance of electronic devices	The problem of assessing the fault tolerance of electronic devices. The basic concepts of probability theory applied to the assessment of fault tolerance of electronic devices. Fault tolerance of an element of technical systems. Types of failures. Bounce distribution functions. Concepts of recovery and failure of elements of electronic devices. Statistical methods for assessing the fault tolerance of electronic devices. Mathematical model of fault tolerance of electronic devices. Factors affecting the fault tolerance of electronic devices.	3			+						+		

20	Internet of Things	Introduction to the Internet of Things. IOT application scenarios. Data transfer technologies for IOT. Hardware part Standard interfaces. Data processing, cloud storage. Practical work with devices.	5			+				+				
21	Cloud technologies telecommunications	Intelligent information systems, IoT systems. Network infrastructure of cloud technologies. Cloud standards. Cloud production. Application cloud services. Cloud computing. Data centers. Storage systems. 5G technology. Data virtualization. Information security. Sealing and multiple access. Extended spectrum methods. Source encoding. Channels with fading.	5					+		+				

