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

APPROVE
«S.Seifullin Kazakh Agrotechnical Research University» NJSC
Chairman of the Board-Rector
It is necessary to « named after »
_________ Tireuov K.M.
«26» 06 2024 y., № 16 protocol

EDUCATIONAL PROGRAM

7M06204 – «Multiservice telecommunication technologies»
(name of the program)

The code and classification of the field of education:	7M06 Information and communication technologies
The code and classification of training areas:	7M062 Telecommunications
The code in the International Standard Classification of Education:	062
Degree/qualification awarded: Bachelor / Specialist/Master/Doctor	According to the educational program 7M06204 – «Multiservice telecommunication technologies»

Astana 2024

Академический комитет по разработке образовательной программы 7М06204 – «Мультисервисные телекоммуникационные технологии»

№	Ф. И. О.	Ученая степень, должность и организация	Подпись членов комитета и печать организации
Председатель			
1	Дунаев Павел Александрович	К.т.н., PhD, и.о. ассоциированного профессора, заведующий кафедрой «Радиотехника, электроника и телекоммуникации» НАО «КАТИУ им. С.Сейфуллина»	
Члены комитета:			
2	Медетов Бекболат Жаксылыкович	PhD, и.о. ассоциированного профессора, кафедра «Радиотехника, электроника и телекоммуникации» НАО «КАТИУ им. С.Сейфуллина»	
3	Жетписбаева Айнур Турсынкановна	PhD, ассоциированный профессор, кафедра «Радиотехника, электроника и телекоммуникации» НАО «КАТИУ им. С.Сейфуллина»	
4	Манбетова Жанат Дусенбаевна	PhD, старший преподаватель, кафедра «Радиотехника, электроника и телекоммуникации» НАО «КАТИУ им. С.Сейфуллина»	
5	Темирбаев Мурат Дильбарханович	Директор департамента информационной безопасности ТОО «KAP Technology»	
6	Тукушев Нурбахыт Батырханович	Главный бизнес-аналитик Департамента Pre Sale Дивизиона по корпоративному бизнесу – филиал АО «Казахтелеком»	
7	Мяло Михаил Валерьевич	Начальник Центральной службы средств диспетчерского и технологического управления (ЦССДТУ) АО «Акмолинская распределительная электросетевая компания»	
8	Ивонин Николай Николаевич	Старший партнер по обучению и развитию/Техническая академия Дирекции «Академия инфокоммуникационных технологий» – филиал АО «Казахтелеком»	
9	Айтқұлов Нұрсұлтан Сәкенұлы	Магистрант 2 курса, кафедра «Радиотехника, электроника и телекоммуникации», группа 20-096-21-13	

The Academic Committee was approved by the order of the Chairman of the Board-Rector of «S.Seifullin KATRU» NAO №374-H from «18» october 2023r.

Educational program «7M06204 - Multiservice telecommunication technologies»

Reviewed on:

at a meeting of the department of «Radio engineering, electronics and telecommunications» protocol
№ 16 from « 03 » 05 2024y.,
at the meeting of the Faculty Council energy faculty for academic quality, protocol
№ 15 from « 21 » 06 2024y.,
at the meeting of the Academic Council of the University, № 10 от «24» 06 2024y.

Date of update « 04» 08 2023 y.

Content

1 Passport of the educational program

1.1 Objective of the educational program

The aim of the educational program is to prepare highly qualified masters based on the integration of education and science in the field of modern and post-modern telecommunication systems. The educational program helps to develop the graduate's readiness to conduct scientific research and experiments, to create service models and resources of multiservice networks and to master the skills of an effective system for training scientific personnel of a new formation.

The standard period for mastering the educational program of the scientific and pedagogical direction in accordance with the State Educational Standard of the Republic of Kazakhstan is 2 years, the total workload of the master's degree program is 120 credits.

Educational program"Multiservice telecommunication technologies" includes the study of the following cycles:

- theoretical training in cycles of basic and specialized disciplines;
- research work of a master's student, including the completion of a master's dissertation (project);
- final state certification in the form of passing a comprehensive exam, preparation and defense of a final thesis.

The resulting learning outcomes:

TR 1 Proficiency in the state and foreign languages to the extent necessary to obtain information of professional content and to express one’s ideas and options for solving professional problems in oral and written form.

TR 2 Carry out innovative engineering projects for the development of hardware and software for radar, radio navigation and space systems using modern methods and automated design systems, advanced development experience and competitive products.

TR 3 Be competent in modern hardware for information security and their safe use in multi-service telecommunication technologies

TR 4 Demonstrate readiness for scientific and pedagogical activities and for further independent learning.

TR 5 To form a natural-scientific worldview necessary for the full development of the individual in the social and professional spheres

TR 6 Be competent in modern issues of multiservice telecommunication technologies according to the Atlas of New Professions of the Republic of Kazakhstan. Be competent in current issues of modern multiservice telecommunication technologies, ready to independently conduct research, analyze and process results in the design, development and modeling of multiservice telecommunication networks using new technical solutions taking into account modern systems and technologies.

TR 7 Demonstrate the ability to use specialized methods of modeling, design, simulation, testing in the field of radio engineering, electronics and telecommunications.

TR 8 Be able to independently solve problems related to the design and operation of multi-service telecommunication systems and networks, perform calculations and reasonably select the necessary equipment in accordance with the calculated and specified technical and economic data

TR 9 Demonstrate knowledge of modern achievements in the field of creation, operation and development prospects of multiservice telecommunication systems and communication networks

TR 10 Master intelligent methods of signal processing, metrological support and mathematical processing of measurement results. TR 11 Apply theoretical and practical knowledge to solve educational, practical and professional problems in the studied area; know the basics and methods of scientific research, academic writing and apply them in the studied area; understand the meaning of the principles and culture of academic honesty.

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://www.enbek.kz/atlas/)

Production unit

Department of Radio Engineering, Electronics and Telecommunications

2 General characteristics of the educational program

The main type of telecommunications network today is a multiservice network.The telecommunications market offers a variety of services, Internet access, wired and wireless data transmission, services based on various infocommunication technologies. The variety of products and services offered on the modern telecommunications market, as well as the convergence of communications, dictate the need to use innovative approaches, mechanisms for organizing and managing business in the field of infocommunications.

The formation of a Master of Technical Sciences, who is able to apply modern technologies for designing multi-service systems and carry out integration, configuring tools taking into account their evolutions, is in demand in the labor market in the field of information and communication systems.

A Master's student who has completed this program will be able to become a specialist in the field of:

-satellite television broadcasting organizations,monitoring and navigation, meteorology,remote sensing of the earth;

- design, implementation and operation of new generation fiber-optic systems,hybrid fiber-coaxial networks;

-maintenance of modern switching communication systems, convergent networks, design of communication systems, the Internet of Things, smart cities.

3 Competency model (portrait) of a graduate

The scope of professional activity of the Master of Technical Sciences (Engineering and Technology) in the field of multiservice telecommunication technologies:

- development, production, installation and technical operation of multi-service systems;
- implementation of scientific, experimental and design work in the field of convergent networks and systems;
- ensuring the technical readiness of communications equipment for operation, timely and high-quality implementation of scheduled maintenance work, technical inspections of equipment;
- control over the correct maintenance of operational and technical documentation and operation of multiservice communication systems.
- control and compliance with safety requirements during operation and maintenance of communication equipment;
- analysis of the operation of technical support equipment for multiservice

communications in order to improve the reliability of their operation.

3.1 Types of professional activity

- scientific research;
- production and technological;
- design and engineering;
- repair and maintenance;
- organizational and managerial;
- innovative,
- calculation and design;
- scientific and pedagogical.

3.2 General educational competencies

- have an idea of the role of science and education in public life, of modern trends in the development of scientific knowledge, of current methodological and philosophical problems of the natural sciences;
- know the methodology of scientific knowledge, the principles and structure of organizing scientific activity;
- to possess psychological methods and means of improving the efficiency and quality of training;
- know the psychology of cognitive activity of master's students in the learning process;
- possess the skills to use the acquired knowledge for the original development and application of ideas in the context of scientific research;
- be able to critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena.

3.3 Basic competencies

- have the skills to conduct information and bibliographic work using modern information technologies,
- to have a professional level of fluency in a foreign language, allowing one to conduct scientific research and teach specialized disciplines at universities,
- be able to generalize the results of research and analytical work in the form of a dissertation/project, have research skills, etc.
- have skills in carrying out educational and pedagogical activities, methods of teaching professional disciplines, and the use of modern information technologies in the educational process.

3.4 Professional competencies

The Master must have the following professional competencies in the types of activities and be able to:

-prepare research and reporting documentation in accordance with established forms;
- master modern methods and means of software modeling;
- evaluate the competitiveness and economic efficiency of the developed multi-service technologies;
- develop technical projects for the implementation of innovative multi-service equipment;
- conduct experiments, analyze results and make recommendations for the implementation of information and communication equipment for convergent networks;
- apply mathematical modeling of telecommunication processes and objects based on both

standard automated design and research packages and independently created original programs;

- conduct measurements and observations, compile descriptions of the research conducted, prepare data for compiling reviews, reports and scientific publications.

4. Base for professional practice

Professional practice (research, production and teaching)involves consolidating theoretical knowledge acquired during the training process, acquiring practical skills and competencies, and mastering advanced experience. Professional practice aims to help master's students gain experience in solving real engineering problems or studying current scientific issues. During the practice, the master's student collects material for a master's thesis/project or scientific/experimental research work related to solving current problems determined by the educational program. The content of the practice is determined by the topic of the final qualifying work.

Research and production internships are planned to be carried out in large scientific, technological and design departments of enterprises, information and computing centers or at the graduation department.

The bases for research/industrial practice are organizations corresponding to the profile of the specialty being studied (or related organizations):

– JSC "Nursultan Nazarbayev International Airport"
– Branches of Transtelecom JSC
– Public Organization "Kazakhstan Federation of Radiosport and Amateur Radio", Astana
– LLP "Ulttyk Telecom", Astana
– Branches of JSC Kazakhtelecom, RK
– JSC "Astana-Regional Electric Grid Company", Astana
– JSC NC Kazakhstan Temir Zholy, Astana
– LLP “Digital system service”, Astana
– LLP "HalykTelecom" Astana
– Sputnik Service 2007 LLP, Astana
– JSC NC KTZ GCUS, Astana
– Branch of JSC "Industrial Construction Telephone Company "Bitelecom" - Akmola PMK communications"
– JSC Astel, Astana
– JSC "Energoinform", Astana
– TOO Central AsiaTelecom, Astana
– MBit LLP, Astana
– RTRC "Kazakhstan", Astana
– KazMedia Center LLP, Astana
– "Allem" Engineering Company LLP, Astana
– JSC "Kazteleradio", Astana
– JSC "Kazinformtelecom", Astana
– JSC "Alma-TV", Astana

5**Structure of the educational program**

With	Name of the cycles of disciplines and types of activities	Total labor intensity	
		in academic hours	in academic credits
1	2	3	4
1	**Theoretical and practical training**	**2640**	**88**
1.1	**Cycle of basic disciplines (BD)**	**1050**	**35**
1)	University component (UC)	600	20
	History and philosophy of science	150	5
	Pedagogy of Higher Education	90	3
	Foreign language (professional)	150	5
	Psychology of Management	150	5
	Teaching practice	60	2
2)	Component of Choice (CC)	450	15
	Information security	150	5
	Security and privacy of cyber-physical systems	150	
	Architecture of networks and telecommunication systems	150	5
	Converged networks	150	
	Methodological foundations of scientific research	150	5
	Theory and practice of technical experiment	150	
1.2	**Cycle of major disciplines (MD)**	**1590**	**53**
1)	University component (UC)	1320	44
	Microwave and optical range devices	150	5
	Intelligent methods of signal processing	150	5
	Hardware and software implementation of coding algorithms on FPGA	120	4
	Research practice	330	11
	Modeling and optimization of telecommunication systems and networks	150	5
	Digital TV and Radio Broadcasting Systems	150	5
	Methods of ensuring electromagnetic compatibility of radio-electronic equipment	150	5
	Embedded and touch devices	120	4
2)	Component of Choice (CC)	270	9
	LPWAN for the Internet of Things	150	5
	Machine-to-machine communications M2M	150	
	Academic writing	120	4
	English for Academic Purposes	120	
2	**Research work**	**720**	**24**
1)	Research work of a master's student, including an internship and the completion of a master's thesis (RWMS)	720	24
3	**Additional types of education (ATE)**		
4	**Final certification**	**240**	**8**

1)	Preparation and defense of a master's thesis	240	8
	Total	**3600**	**120**

Appendix 1 Academic Calendar

Appendix 1 to the Academic Calendar
Approved by the Academic Council of the NJSC "S.Seifullin KATIUS", Protocol №12, of 28.03.2024 y.

Schedule of the educational process for the 2024-2025 academic year for the educational program Energy faculty
MASTER

Courses	September					October					November				December				January					February				Mart				April				May					June				July					August			
	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25
	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
	7M07103 - "Electricity networks", 7M07104 - "Power supply of industrial enterprises cities and agro industrial complexes" (Scientific & pedagogical direction)																																																				
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/TD/RP	RP/S	RP/S	H/S	H/S	H/S	H/S	H	H	H	H	H	H	H
II	H	/U	/U	/U	/U/	/U/	/U	/U	/U/TP	/U/TP	/U	/U	/U/RP	/U/RP	/U/RP	/U/RP	E/P	E/P	H	H	H	H	U/RP	U/RP	U/RP	U/RP	U	U	U	U	U	U	U	U	U	U	U	U	FE	FE	FE	FE	FE	FE									
	7M07114 -"Power supply of industrial enterprises cities and agro industrial complexes", winter reception																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/TD/RP	RP/S	RP/S	H/S	H/S	H/S	H/S	H	H	H	H	H	H	H
II	H	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/RP	/U/RP	/U/RP	/U/RP	E/P	E/P	H	H	H	H	U/RP	U/RP	U/RP	U/RP	U	U	U	U	U	U	U	U	U	U	U	U	FE	FE	FE	FE	FE	FE									
	7M07101 - "Thermal Engineering", 7M07102-"Heat and gas supply, ventilation and eco-engineering in agriculture "																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/H	H	H	H	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/TD/H	D/H/	S/H	S/H	S/H	S/H	S/H	H	H	H	H	H	H	H
II	H	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/H	H	H	H	U/TP	U/TP	U/EP	U/EP	U/EP	U/EP	U/EP	U/EP	U/EP	U/EP	U/EP	U	U	U	U	U	FE	FE	FE	FE	FE	FE									
	7M07102-"Heat and gas supply, ventilation and eco-engineering in agriculture " , winter reception																																																			
I																			H	H	H	H	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/TD/H	H/S	H/S	H/S	H/S	H/S	H/S	H	H	H	H	H	H	H
	7M06204 - "Multiservice Telecommunication Technologies "																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U/TP	/U/TP	/U/TP	/U/TP	/U	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	E/P	E/P	P/TD/H	H/S	H/S	H/S	H/S	H/S	H/S	H	H	H	H	H	H	H
	7M06204 - "Multiservice Telecommunication Technologies ", winter reception																																																			
I-II	H	/U	/U	/U/TP	/U/TP	/U	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	E/P	E/P	H	H	H	H	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U	/U	/U	E/P	E/P	P/TD/H	H/S	H/S	H/S	H/S	H/S	H/S	H	H	H	H	H	H	H
	7M06205 - "Radio-electronic technologies and systems "																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U/TP	/U/TP	/U/TP	/U/TP	/U	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U	/U	E/P	FE	FE	FE	FE	FE	FE									
	7M07105 - "Control of technical systems"																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U	/U/TP	/U/TP	/U/TP	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	P/TD/H	S/H	S/H	S/H	S/H	S/H	S/H	H	H	H	RP	RP	RP	RP
II	RP	/RP/U	/RP/U	/RP/U	/RP/U	/RP/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	FE	FE	FE	FE	FE	FE									
	7M08705 - "Energy supply and automation of agriculture"																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U	/U/TP	/U/TP	/U	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U/RP	/U	/U	/U	/U	/U	E/P	E/P	P/TD/H	S/H	S/H	S/H	S/H	S/H	S/H	H	H	H	RP	RP	RP	RP
II	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	U/RP	E/P	FE	FE	FE	FE	FE	FE									
	7M07105 - "Control of technical systems", winter reception																																																			
I	PW	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	/U	E/P	E/P	H	H	H	H	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TP	/U/TR	/U/TP	/U/TP	/U/TP	/U/TP	E/P	E/P	P/TD/H	S/H	S/H	S/H	S/H	S/H	S/H	H	H	H	RP	RP	RP	RP

Conventional signs

Presentation week	Theoretical training	Enrollment in disciplines	Examination session	Passing FX	Holidays	Summer semester	Final examination	Teaching practice	Educational practice	Industrial practice	Undergraduate practice
PW	•	TD	E	P	H	S	FE	TP	EP	IP	U

Public holidays

Director of the Institute of Postgraduate Education — Husainova Zhibek Seitovna

Dean of the Faculty Energy — Isenov Sultanbek Sansyzbayevich

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

Considered at the meeting
of Academic Council
of the University

Protocol № 20
"26" 06 2024y.

APPROVED
Member of the Board
Vice-Rector for Research
and innovation activities
NC JSC "KATIU"
Syrgaliev E.O.
20 24y.

CURRICULUM

for 2024-2026 academic year
For the modular education program 7M06204 Multiservice telecommunication technologies
by the speciality/group of educational programmes M096 – Communications and communication technologies
Degree: Master's program by specialization (Scientific & pedagogical direction)
Form of education: Full-time (MS 2 years) semester
Entry year: 01-09-2024 (summer reception)

Module code	Module name	Discipline cycle	Discipline component	Code of subject	Subject name	Academic credits	Control in the academic period: Exams	Differentiated test(practice)	Differentiated test(course paper)	Practice/SRW	Term paper/project	Volume of hours: Total	In-class learning	including: Lectures	Practice	Lab practicals	MSIWT	MSIW	Distribution of credits per academic period: 1 course		2 course	
																			1	2	3	4
																			Number of weeks in the academic period: 15	15	15	15
					General modules																	
1	Professional practice	BS	UC	PP 5205	Pedagogical training	2				60		60.0		0	0	0	0	0		2.0		
					Modules of specialty/education programm																	
2	Proffesional practice	AS	UC	IP 5319	Research practice	5				150		150.0		0	0	0	0	0		5.0		
3		AS	UC	IP 6320	Research practice	6				180		180.0		0	0	0	0	0			6.0	
4	Research and pedagogical	BS	UC	IYaP 5205	Foreign language (professional).	5	1					150.0	45.0	0	45	0	20	85	5.0			
5		BS	UC	IFN 5205	History and philosophy of science	5	2					150.0	45.0	15	30	0	20	85		5.0		
6		BS	UC	PVSH 5205	Pedagogics of higher school	3	2					90.0	30.0	15	15	0	12	48		3.0		
7		BS	UC	PU 5205	Psychology of management	5	2					150.0	45.0	15	30	0	20	85		5.0		
8		AS	ES	AP 6318	Academic writing.	4	3					120.0	45.0	0	45	0	16	59			4.0	
9				AYaDAC 6321	English for Academic Purposes		3						45.0	0	45	0	16	59				
10		BS	ES	MONI 5206	Methodological bases of scientific research	5	2					150.0	45.0	15	30	0	20	85		5.0		
11				TPTE 5210	Theory and practice of technical experiment		2						45.0	15	30	0	20	85				
12		AS	UC	IMOS 5314	Intelligent signal processing methods	5	1					150.0	45.0	15	0	30	20	85	5.0			

13	Telecommunications	AS	UC	APRAPLISP 5301	Hardware-software implementation of algorithms for programmable logic integrated circuits (PLIC)	4	1					120.0	45.0	15	0	30	16	59	4.0			
14		AS	UC	PSOD 5301	Microwave and optical range devices	5	1					150.0	45.0	15	15	15	20	85	5.0			
15		AS	UC	MOTSS 6301	Modeling and optimization of telecommunication systems and networks	5	3					150.0	45.0	15	15	15	20	85			5.0	
16		AS	UC	CST 6315	Digital broadcasting systems	5	4					150.0	45.0	15	30	0	20	85				5.0
17		AS	UC	VSU 6316	Embedded and touch devices	4	4					120.0	45.0	15	0	30	16	59				4.0
18		AS	UC	MOESRS 6312	Methods of provision of the electromagnetic compatibility of radio electronic equipment	5	4					150.0	45.0	15	30	0	20	85				5.0
19		BS	ES	BKKS 5213	Security and privacy of cyber-physical systems	5	1					150.0	45.0	15	0	30	20	85	5.0			
20				IB 5213	Information security		1						45.0	15	0	30	20	85				
21		BS	ES	KS 5209	Convergent networks	5	1					150.0	45.0	15	30	0	20	85	5.0			
22				ASST 5203	The architecture of networks and telecommunications systems		1						45.0	15	30	0	20	85				
23		AS	ES	MKM 6317	Machine-to-machine communication M2M	5	3					150.0	45.0	15	0	30	20	85			5.0	
24				LDIV 6308	LPWAN for Internet of things		3						45.0	15	0	30	20	85				
					Scientifically research																	
25	SRWM	RW	CS	NIRMVPSVM D 5501	Master's research work, including internship and master's thesis	1				30		30.0		0	0	0	0	0	1.0			
26		RW	CS	NIRMVPSVM D 5514	Master's research work, including internship and master's thesis	5				150		150.0		0	0	0	0	0		5.0		
27		RW	CS	NIRMVPSVM D 6515	Master's research work, including internship and master's thesis	10				300		300.0		0	0	0	0	0			10.0	
28		RW	CS	NIRMVPSVM D 6516	Master's research work, including internship and master's thesis	8				240		240.0		0	0	0	0	0				8.0
1	**General education subjects(GER)**					**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Core subjects(GER/CS)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component(GER/UC)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Electives(GER/ES)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Base requirements(BS)**					**35**		**0**	**0**	**60**	**0**	**1050**	**300**	**90**	**180**	**30**	**132**	**558**	**15**	**20**	**0**	**0**
	Core subjects(BS/CS)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component(BS/UC)					20		0	0	60	0	600	165	45	120	0	72	303	5	15	0	0
	Electives(BS/ES)					15		0	0	0	0	450	135	45	60	30	60	255	10	5	0	0
3	**Profession requirements(VRS)**					**53**		**0**	**0**	**330**	**0**	**1590**	**405**	**120**	**135**	**150**	**168**	**687**	**14**	**5**	**20**	**14**
	Core subjects(VRS/CS)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component(VRS/UC)					44		0	0	330	0	1320	315	105	90	120	132	543	14	5	11	14
	Electives(VRS/ES)					9		0	0	0	0	270	90	15	45	30	36	144	0	0	9	0
Total of theoretical course						112	16	0	0	1110	0	3360	705	210	315	180	300	1245	30.0	30.0	30.0	22.0
AC	**Additional courses**															0						
FA	**Final attestation**					8									240.0							
	Of the Master's thesis					8				4					240							
	Total					120				1114		3600	705	210	315	180	300	1245				

Examinations (semester)* - The final form of control on Physical Culture and types of professional practice is a differentiated credit.
The modular curriculum is made in accordance with the standard curriculum of the speciality (approved by the Order of the MES RK from 16.0[illegible].2013 № 343);
State obligatory standards of education (approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan from 23.08.2012 № 1080), modular educational programme of the specialty.
The modular curriculum was considered and approved at the meeting of the methodical commission of the faculty, Protocol № 20

Director of Department of Academic Affairs	KHUSSAINOVA ZHIBEK SEITOVNA
Dean of the Faculty of Energy	Issenov Sultanbek Sansyzbaevich
Head of the Department	Dunayev Pavel Alexandrovich

Appendix 3 Description of the disciplines of the BD cycle

№	Наименование дисциплины	Краткое описание	Кол-во кредитов	Формируемые компетенции (коды)										
				PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
Цикл базовых дисциплин (БД) **Вузовский компонент**														
1	Psychology of management	Forms the skills of the methodological and dialectical approach to the research, summarizes philosophical knowledge, studies the issues of historical development, its structure, analyzes the patterns and trends of scientific knowledge, systematizes the effectiveness of research work.	5		+		+			+				
2	Pedagogics of higher school	It allows undergraduates studying in the scientific and pedagogical direction to understand common problems, methodological and theoretical foundations of Higher School pedagogy, skills of analysis of teaching and upbringing, elements of modern planning and organization technologies.	3		+		+			+				
3	Foreign language (professional)	Forms foreign language communicative competence as a significant component of professional competence and the culture of scientific writing among students, which allows them to integrate into international scientific activities, allows them to freely operate the scientific and conceptual apparatus in their specialty, expand the scientific and information base, acquire broad scientific knowledge, identify promising areas of professional and scientific activities.	5	+						+				
4	Psychology of management	Forming the skills of managing organized activities of people through the study of psychological laws and patterns of management and quality of work, developing the ability to make decisions scientifically, planning the activities of other people, and managing into an organization	5		+		+			+				
5	Pedagogical practice	Pedagogical practice is aimed at acquiring professional competencies in the field of teaching, namely, consolidating and deepening the theoretical knowledge on pedagogy and teaching methods obtained in the learning process by deepening the skill of planning, organizing and conducting practical training sessions on the basis of the relevant department of the department. In the process of passing pedagogical practice, undergraduates get acquainted with the	2		+		+							

		components of pedagogical professional activity, with the educational and methodological complex of materials, the structure, forms and methods of conducting training sessions, learn to manage and organize the activities of the educational team, evaluate students' knowledge, make up and fill out reports, and also acquire skills of working in a labor collective. According to the results of pedagogical practice and practical training, undergraduates prepare and defend a report.												
Цикл базовых дисциплин (БД) Компонент по выбору														
6	The architecture of networks and telecommunications systems	New generation network technologies (NGN), problems of transition to new generation networks, three-level NGN architecture on the IMS platform, main scenarios of transition to NGN.	5			+		+		+				
7	Convergent networks	The concept of a convergent network. The term FMC is the concept of the protocol Convergence of telecommunication networks NGN network, the basis of the NGN network Levels of the functional model of the NGN network Data storage. Providers Advantages of the NGN network and their difference from the traditional network. Self-similar traffic of multiservice networks. Multiservice traffic distribution models. Principles of traffic management in the core of the new generation NGN transport network	5			+		+		+				
8	Methodological bases of scientific research	Overview of the main directions of development of scientific research in Kazakhstan and abroad. Methodology and methods of scientific research. The choice of research directions and stages of research work. Processing the results of experimental studies. Registration of research results and the transfer of information. Introduction and effectiveness of research. Scientific organization of intellectual labor. The basic principles of management research group.	5		+		+	+		+				+
9	Theory and practice of technical experiment	Introduction. The main provisions and concepts of probability theory and mathematical statistics. Theory of random errors. Processing of experimental data of measurement results. Statistical processing of experimental research results. Methods of graphic processing of experimental research results	5		+		+	+		+				+

Цикл профилирующих дисциплин (ПД) **Вузовский компонент**														
10	Microwave and optical devices	Overview of the development of microwave technology. A brief theory of slowing systems. The device and the principle of the flight and reflective klystrons. The device and the principle of operation of lamps traveling and reverse waves. Device and physics of the Gunn diode, generators on the Gunn diode, its amplifying properties.	5				+		+	+				
11	Intelligent signal processing methods	Biological neuron; Artificial neuron model; Neural network model – fully connected multilayer perceptron; Neural network training algorithms, INS training with or without a teacher; Modern types of INS used in solving practical problems: recurrent networks, spike networks, generative – adversarial networks, convolutional networks and others; Implementation of INS on FPGA, Verilog generation neural network code from Python libraries; Algorithms for parallel execution of neural computations on FPGAs; Signal preprocessing and preparation of a training database for INS.	5							+		+		

Appendix 4 Description of disciplines of the PD cycle

№	Наименование дисциплины	Краткое описание	Кол-во кредитов	Формируемые компетенции (коды)										
				PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
1	Hardware-software implementation of algorithms for programmable logic integrated circuits (PLIC)	Mathematical foundations of coding. Model codes and coding systems. Information characteristics of digital communication systems. Algebraic methods of encoding and decoding in the spectral domain. Chase, soft-decoding, maximal a posteriori probability algorithm, Log-MAP, Max-Log-MAP, OSD. Software implementation of noise-tolerant coding algorithms on MATLAB and ModelSim. Software and hardware implementation decoder debug board FPGA and SNK.	4			+		+		+	+			
2	Research practice	The research practice of undergraduates is conducted in order to collect, analyze and generalize scientific material, develop original scientific ideas for the preparation of a master's thesis, gain skills for independent research work, practical participation in research work of research teams.	11				+	+		+				+
3	Modeling and optimization of telecommunication systems and networks	Basic concepts, principles of modeling in telecommunication systems and networks; methods and methods of modeling in telecommunication systems and networks. Principles of construction of various telecommunication systems and networks. Programming packages in algorithmic languages of different levels for modeling of physical processes and information flows in various telecommunication systems and networks. The algorithms of modeling of information flow and physical processes, and their carers. Methods and tools for creating software shells of models of objects under study. Methods and means of processing information obtained from the simulation. Methods of calculation and quality control of information obtained from the simulation.	5					+		+	+			
4	Digital broadcasting systems	Principles of high-quality and high-definition television surveillance, transmission of enhanced information, optical-digital and electronic-optical conversion devices in television, transmission and collection of state television signals, transmission of television signals via radio channels, stereoscopic television systems	5					+		+	+			

5	Methods of provision of the electromagnetic compatibility of radio electronic equipment	General information about unintended interference. Additive and multiplicative interference. Basics of EMC prediction. Sources and receptors for electromagnetic interference. Equation of balance between noise immunity and emission of interference. Information measure of proximity-divergence of two signals (interference). Classification of problems of optimal assignment of radio frequencies. Radiotransmitteremissions.	5					+	+	+			+	
6	Embedded and touch devices	Cyber-physical approach. Architecture of embedded devices. Organization of the interface and input-output systems in embedded devices and systems. Wired and wireless interfaces in embedded devices and systems. Modes of operation of embedded devices and systems. Operating systems of embedded devices and systems. Embedded Security Typical use of embedded devices and systems.	4					+	+	+	+			
Цикл профилирующих дисциплин (ПД) Компонент по выбору														
7	Information security	Terminologicalbasisofinformationsecurity. General methodological principles of information security theory. Stages of information security development. Information security system requirements. Classification and analysis of information security threats. Causes, types, channels of leakage and distortion of information. Functions and tasks of information security. Methods of formation of protection functions. Information security of the Republic of Kazakhstan.	5							+			+	
8	Security and privacy of cyber-physical systems	Introduction to Security and Privacy CPS. Key concepts in cyber-physical systems. Attack models for CPS. Security issues in the real-world CPS.	5							+			+	
9	LPWAN for Internet of things	TheconceptofIoTandIoE. LoRa modulation. Characteristics and LoRa and NB-IoT frequency bands. Building an M2M / IoT network based on NB-IoT technology. LoRaWAN architecture. Network server, device classes, scalability, Uplink and downlink messages. Gateways and nodes, antennas for LoRa. Building solutions and prototyping. Protocols: MQTT, HTTP integration. Modeling and data processing. Localization and network security. Large-scale network deployment.	5				+		+	+				
10	Machine-to-machine communication M2M	Connection protocols M2M. Connection protocols. M2M Communication protocols. Connection protocol users.	5				+		+	+				

		Choosing the right M2M communication protocol. Wireless technology within short range devices. Technologies for M2M with limited coverage. Technology for M2M with a large coverage area. LPWA wireless technologies within IMT systems. Wireless technology for critical applications.												
11	Academic writing.	Course is designed to develop and sharpen students' academic and professional writing skills and strategies in English necessary for successful written communication in academic, professional, and workplace settings. During the course, students studythe features of academic writing, using library catalogues and websites. Practice discursive essay writing: outline, thesis statement, body paragraphs and conclusion. Methods of paraphrasing. APA style: references, citation. Students learn the types of abbreviations, academic vocabulary, the use of articles.	4	+						+				+
12	English for Academic Purposes	Comprehensive theoretical and linguistic, practical and informational-analytical training in order to perform functions related to the use of a foreign language in professional and scientific activities: possession of public speaking skills, conducting discussions, the ability to work with information from various sources, edit texts of professionally significant content in a foreign language.	4	+						+				+