

«Mukhametzhan Tynyshbayev ALT University» JSC



I APPROVE

Chairman of the «ALT University» JSC

M.S. Zharmagambetova
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Decision of the Academic Council of
«ALT University» JSC

from "30" 05 2025 year (Protocol № 10)

PROGRAM
THE ENTRANCE EXAM TO THE DOCTORAL PROGRAM

Group of educational programs
"D096 - Communications and communication technologies"

Almaty, 2025

The program of the entrance exam was discussed and received a positive decision at the meeting of the Department of Information and Communication Technologies, Protocol №8 of April 17, 2025.

Head of the Department of "ICT"  D. Kassymova

Questions of the entrance exam were considered and recommended at the meeting of the Council of the Institute of "Energy and Digital Technologies", «26» April 2025, protocol № 9.

Chairman of the Institute's Council «E&DT»  A. Toygozhinova

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1. The purpose of the entrance exam for a group of educational programs

The purpose of the entrance exam for groups of educational programs is to determine the theoretical and practical readiness of the applicant for doctoral studies, the level of compliance of knowledge, skills and abilities with the requirements of doctoral studies in the field of training.

The entrance exam for doctoral studies consists of writing an essay and an exam on the profile of a group of educational programs.

2. Regulations for conducting the entrance exam for doctoral studies in a group of educational programs

The duration of the entrance exam is 3 hours and 30 minutes, during which the applicant writes an essay, answers an electronic examination ticket consisting of 3 questions. The list of questions and the topic of the essay are formed in random order. The maximum score for the entrance exam is 100 points, of which the essay is 20 points, the profile exam is 50 points, the interview is 30 points.

3. Types and evaluation criteria

3.1 Types and criteria of essay evaluation

Types of essays	Description	The volume of the essay
Motivational	Argumentation of the applicant about the motivations for research activities (research statement)	At least 250 words
Scientific and analytical	Justification of the relevance and methodology of the proposed research (research proposal) by the incoming	
Problem-themed	Presentation of the author's position on topical aspects of subject knowledge	

Criteria	Descriptors	Points
Depth of disclosure of the topic	the problem is revealed at a theoretical level, with the correct use of scientific terms and concepts	4
	one's own point of view (position, attitude) is presented when disclosing the problem	4

Argumentation, evidence base	the presence of arguments from scientific literature and sources corresponding to the topic of the essay	4
Compositional integrity and logic of presentation	the presence of compositional integrity, the structural components of the essay are logically connected	4
Speech culture	demonstration of a high level of academic writing (vocabulary, knowledge of scientific terminology, grammar, stylistics)	4
	Maximum number of points	20

3.2 Structure and content of the exam according to the profile of the group of educational programs

The exam on the profile of the group of educational programs includes 3 blocks of questions, of which: the 1st question determines the level and consistency of theoretical knowledge; the 2nd question reveals the degree of formation of functional competencies; the 3rd question is aimed at determining systemic competencies. The maximum number of points is 50.

The electronic examination ticket consists of 3 questions:

Blocks	The nature of the question	Number of points
1st question	theoretical - determines the level and consistency of theoretical knowledge	10
2nd question	practical - reveals the degree of formation of functional competencies (the ability to apply techniques, technologies and techniques in the subject area)	20
3rd question	reveals a systematic understanding of the subject area under study, specialized knowledge in the field of research methodology (system competencies)	20
total		50

Criteria for evaluating the answers to the questions of the electronic examination card:

Question	Evaluation criteria	Number of points
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1st question	demonstrates knowledge of the main processes of the studied subject area; the depth and completeness of the disclosure of the issue	5
	logically and consistently expresses his own opinion on the issue under discussion	3
	has a conceptual and categorical apparatus, scientific terminology	2
	Total	10
2nd question	applies methods, techniques, technologies to solve problems in the subject area	7
	argues, compares, classifies phenomena, events, processes; draws conclusions and generalizations based on practical skills	7
	analyzes information from various sources	6
	Total	20
3rd question	critically analyzes and evaluates theoretical and practical developments, scientific concepts and current trends in the development of science	7
	synthesizes methodological approaches in the interpretation of the main problems of subject knowledge	7
	identifies causal relationships in the analysis of processes, phenomena, events	6
	Total	20
	in total	50

3.3 Interview evaluation criteria

№	Criteria	Descriptors	Points
1.	Motivation	Argumentation of motives for studying for a doctoral degree in a selected OP and admission to a certain university. Vision of prospects for professional and personal growth upon completion of training.	5
2	Research competence	Possession of research skills and experience necessary for research activities in a specific subject area.	10

3.	Creativity	Non-standard thinking, creative and alternative approaches to solving problems, situational tasks.	10
4.	Communicativeness	The ability to briefly, representatively, logically, argumentatively state your point of view, make generalizations and conclusions. Language proficiency.	5
Maximum number of points			30

4. Content of examination materials

4.1 Content of the Essay topic

№	Эссе тақырыбы (қазақ тілінде)	Эссе тақырыбы (орыс тілінде)	Эссе тақырыбы (ағылшын тілінде)
1	5G технологиясының дамуы және қазіргі телекоммуникациялық жүйелерге әсері	Развитие 5G и его влияние на современные телекоммуникационные системы	Development of 5G and its Impact on Modern Telecommunication Systems
2	Радиотехника мен электроникадағы заттар интернетінің (IoT) болашағы	Будущее Интернета вещей (IoT) в радиотехнике и электронике	The Future of the Internet of Things (IoT) in Radio Engineering and Electronics
3	Қауіпсіздік пен қорғанысты қамтамасыз етудегі радиотехникалық технологиялардың рөлі	Роль радиотехнических технологий в обеспечении безопасности и обороны	The Role of Radio Engineering Technologies in Ensuring Security and Defense
4	Жартылай өткізгіш технологиялардың эволюциясы және олардың қазіргі заманғы электрондық құрылғыларға әсері	Эволюция полупроводниковых технологий и их влияние на современные электронные устройства	The Evolution of Semiconductor Technologies and their Impact on Modern Electronic Devices
5	Жасанды интеллекттің телекоммуникациялық жүйелерге әсері	Влияние искусственного интеллекта на телекоммуникационные системы	The Impact of Artificial Intelligence on Telecommunication Systems
6	Сымсыз сенсорлық желілердің дамуы және олардың әртүрлі салаларда қолданылуы	Развитие беспроводных сенсорных сетей и их применение в различных отраслях	The Development of Wireless Sensor Networks and Their Applications in Various Industries
7	Аналогтық және цифрлық байланыс жүйелерінің салыстырмалы талдауы	Сравнительный анализ аналоговых и цифровых систем связи	Comparative Analysis of Analog and Digital Communication Systems
8	Радиожилік сәйкестендіру (RFID):	Радиочастотная идентификация (RFID):	Radio Frequency Identification (RFID):

	технологиялар және қолдану салалары	технологии и области применения	Technologies and Applications
9	Ақылды үй технологияларының дамуы және перспективалары	Разработка и перспективы технологий умного дома	Development and Prospects of Smart Home Technologies
10	Телекоммуникациялық технологиялардың қоғамға әсері	Воздействие телекоммуникационных технологий на общество	The Impact of Telecommunication Technologies on Society

4.2 The content of the sections on the blocks submitted for the entrance exam

Examination materials for the entrance exams to the doctoral program for groups of educational programs, including the subject of essays, examination questions on the profile are made in three languages: Kazakh, Russian and English.

The topics of the examination questions correspond to the selected sections from the curricula of the cycles provided for by the groups of educational programs "D096 - Communications and communication technologies":

№	Name of disciplines
1	Measurements in telecommunication systems
2	Theory and experimental technique in RET
3	Digital transmission systems

4.3 The content of the sections on the blocks submitted for the entrance exam

Block 1

1.1. Measurements in telecommunication systems.

Basic concepts and terms. Types and methods of measurements. Classification of measuring instruments. Unity of measurements. Classification of measuring technologies of modern telecommunications. System and operational equipment. Measurement errors and processing of measurement results. Systematic error. Classification of measuring technologies of modern telecommunications. Voltage and current measurement. Study of signal shape and parameters. Measuring signal spectra. 1.2. Organization and preparatory work on the design of the VOLS.

1.2. Measuring technologies of modern telecommunications.

Information model of the measurement system. Single and multiple measurements, their errors, registration of measurement results. Bit errors and their impact on digital transmission parameters. Signal spectrum analysis. Mathematical expectation, dispersion and standard deviation of the measurement result. Indirect measurement and its errors. Direct unequal measurements. Measuring technologies SDH, PDH. Measuring technology for operational measurements of communication systems. Optical backscatter reflectometer. Measurement of the main parameters of the linear path of the fiber optic line. Methods and instruments for measuring transmission parameters of WDM systems.

Block 2

2.1. General provisions of theory and experimental techniques.

Introduction to the theory of experiment in RET. The main stages of planning an experiment in RET. Methods for processing experimental data. Experimental research methodologies. Measurement and analysis of electrical signal parameters. Experimental methods for measuring the frequency and period of signals. Experiments with antennas and radio wave propagation. Experimental studies of radio frequency devices. Experiments with modulation and demodulation of signals. Experimental studies of digital communication systems.

2.2. Experimental work in RET.

Experiments with microcontrollers and programming in RET. Experimental studies of radio frequency and microwave emitters. Experiments with sensors and detectors in electronic devices. Experiments with microwave devices and optical systems. Experiments using Internet of Things (IoT) technologies in RET. Experiments using blockchain technologies in RET.

Block 3

3.1. Technologies and standards of mobile systems.

General provisions. Block diagram of the transmission channel. Application of DWDM systems. Digital methods of information transmission. Fundamentals of a systems approach to the design of systems and transmission lines. Reliability indicators of non-repairable objects. Reliability indicators of restored objects. Statement of the optimization problem. Optimization methods. General principles of rationing. Basic definitions. The main standardized indicators of the quality of functioning of digital channels and paths. Calculation of the length of the regeneration section of the CBSP using electrical cables. Calculation of sections of fiber-optic transmission line.

3.2. EMC and mobile communication systems.

Features of designing fiber optic lines based on SDH. Organization of the technical operation process. Organization of technical operation and management systems. Purpose and interaction of control stations during the operation of ASP and DSP PCI. Measurements during operation of the DSP. General provisions. Operating modes of clock network synchronization. General principles of building a TSS network. Synchronization in SDH networks. Optimization of the period of technical maintenance to minimize the downtime rate. Optimization of the period of technical maintenance at a minimum of costs. Operational standards for error parameters in SDH paths. Certification of DSP PCI. Certification of DSP SCI. Certification of VOSP-SR. LAC. General provisions for maintaining production documentation.

4.4 Interview questions

1. Tell us about your experience in the field of radio engineering, electronics and telecommunications.
2. Modern and scientifically based definition of RET
3. Functional areas of RET
4. What projects in the field of radio engineering or electronics have you implemented?
5. What are the latest innovations in telecommunications, radio or electronics that you are aware of and how are they impacting the industry?
6. What is noise immunity and how can it be improved in radio systems based on your research?
7. Telecommunications market research
8. Quality indicators of telecommunication services
9. Ensuring the reliability of information transmission and storage
10. Cryptographic methods for protecting computer information

11. Methods and means of protection against electromagnetic radiation and interference
12. How do you evaluate the quality of signals in telecommunications systems?
13. Measurement of energy parameters of TCS devices
14. Analysis of the effectiveness of telecommunication systems
15. Noise-resistant coding in telecommunication systems

5. Recommended literature

5.1 Basic literature

1. "Digital transmission systems" Ivanov A.A., Ospanova N.A. Almaty: KazATK, 2012.
2. Fiber optic technology: Current status and prospects. Dmitriev S.A., Slepov N.N. Moscow, VOT LLC, 2015.
3. Fiber-optic networks and communication systems. Sklyarov O.K. St. Petersburg: Lan, 2010.
4. WDM Technology and Testing Guide. Andre Girard. M.: EXPO, 2011.
5. Design and technical operation of digital telecommunication systems and networks. Textbook for universities / E.B. Alekseev, V.N. Gordienko, V.V. Krukhmalev and others; Edited by V.N. Gordienko and M.S. Tveretsky. – M.: Hotline – Telecom, 2012. – 392 p.
6. Ryzhikov Yu. I. Simulation modeling. Theory and technology. - SPb: CORONA print; M.: Altex-A, 2014. - 384 p.
7. Sovetov B.Ya., Yakovlev S.A. Systems modeling. – M.: Higher School, 2015. – 271 p.
8. Kuzmichev D.A., Radkevich I.A., Smirnov A.D. Automation of experimental research, - M., 2013.
9. Stupin Yu.V. Methods for automating physical experiments and computer-based installations. - M., 2013.

5.2 Additional literature

1. Lipskaya M.A., Mamilov B.E., Zaltsman Yu.M. Methodological instructions for conducting practical classes are compiled in accordance with the working curriculum of the discipline "Digital Transmission Systems" for undergraduates of the master's specialty 6M071900 - Radio engineering, electronics and telecommunications. Almaty, KazATK, 2017.
2. Lipskaya M.A., Zaltsman Yu.M. Guidelines for independent work under the guidance of a teacher are compiled in accordance with the working curriculum of the discipline "Digital Transmission Systems" for undergraduates in the master's specialty 6M071900 – Radio engineering, electronics and telecommunications. Almaty, KazATK, 2017.
3. Synchronization of digital communication networks. Breni S. M.: Mir, 2013.
4. Synchronization networks. Interaction scenarios. Biryukov N.L., Triska N.R. Networks and telecommunications, No. 08-09, 2015.