«Mukhametzhan Tynyshbayev ALT University» JSC

PROGRAM
THE ENTRANCE EXAM TO THE DOCTORAL (PROFILE) 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 Board of the Institute "EiCT" **Togozhinova A.Zh.**

CONTENT

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

The objectives of the entrance examination for groups of educational programs are to assess the theoretical and practical readiness of applicants for doctoral studies, as well as the level of their knowledge, skills, and competencies in accordance with the requirements of the chosen field of study.

The doctoral entrance examination consists of an interview and an exam on the profile of the educational program group.

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

The duration of the entrance examination is 2 hours and 30 minutes, during which the applicant answers an electronic exam ticket consisting of 3 questions. The list of questions is generated randomly. The maximum score for the entrance examination is 80 points, distributed as follows: exam on the profile of the educational program group – 50 points, interview – 25 points, and a recommendation letter from enterprises or organizations (if available) – 5 points.

3. Types and evaluation criteria

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

The exam in 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 exam 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
The 3rd question	it 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
1st question	demonstrates knowledge of the main processes of the subject area under study; the depth and completeness of the disclosure of the issue	5
	logically and consistently expresses his own opinion on the issue under discussion	3
	knows the conceptual and categorical apparatus, scientific terminology	2
TOTAL		10
2nd question	applies methods, techniques, and 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
The 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 cause-and-effect relationships in the analysis of processes, phenomena, events	6
TOTAL		20
In total		50 points

3.2 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.	5
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		25

4. Content of examination materials

4.1 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 "D100 - Automation and control":

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

4.2 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 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.

4.3 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. Dmitrieev 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.