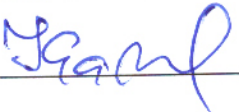





The program of the entrance exam was discussed and received a positive decision at the meeting of the Department of Automation and control, Protocol №8 of April 18, 2024.

Head of the Department of "AC"  K. Sansyzbay

The program of the entrance exam was reviewed and recommended at the meeting of the Council of the Institute "Automation and Telecommunications", Protocol № 5 of April 26, 2024.

Chairman of SI "AT"  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, passing a test for readiness to study in doctoral studies 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 4 hours and 20 minutes, during which the applicant writes an essay, passes a test for readiness for doctoral studies, 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 10 points, the TGO is 30 points, the GOP profile exam is 40 points, the interview is 20 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 3 points	the problem is revealed at a theoretical level, with the correct use of scientific terms and concepts	2
	one's own point of view (position, attitude) is presented when disclosing the problem	1
Argumentation, evidence base 3 points	the presence of arguments from scientific literature and sources corresponding to the topic of the essay	3
Compositional integrity and logic of presentation 2 points	the presence of compositional integrity, the structural components of the essay are logically connected	2
Speech culture 2 points	demonstration of a high level of academic writing (vocabulary, knowledge of scientific terminology, grammar, stylistics)	2
	Maximum number of points	10

### 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 40.

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)	15
3rd question	reveals a systematic understanding of the subject area under study, specialized knowledge in the field of research methodology (system competencies)	15
<b>Total</b>		<b>40</b>

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 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
	<b>Total</b>	<b>10</b>
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	5
	analyzes information from various sources	3
	<b>Total</b>	<b>15</b>
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	5
	identifies causal relationships in the analysis of processes, phenomena, events	3
	<b>Total</b>	<b>15</b>
	<b>In total</b>	<b>40</b>

### 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.	6
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.	4
Maximum number of points			20

## 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	ҚР темір жолдары желісіндегі электрлік орталықтандыру жүйесінің қазіргі жағдайы және даму болашағы	Современное состояние и перспективы развития систем электрической централизации на сети железных дорог РК	Current state and prospects of development of electric centralization systems on the railway network of the Republic of Kazakhstan
2	Темір жол автоматикасы мен телемеханикасы жүйелерінің сенімділігін арттыру әдістері	Методы повышения надежности систем железнодорожной автоматики и телемеханики	Methods of increasing the reliability of railway automation and telemechanic systems
3	Темір жол автоматикасы мен телемеханикасы құрылғыларының функционалдық бақылау және мониторинг жүйелерінің қалыптасуы және даму перспективалары	Становление и перспективы развития систем функционального контроля и мониторинга устройств железнодорожной автоматики и телемеханики	Formation and prospects of development of functional control and monitoring systems for railway automation and telemechanic devices
4	Темір жол автоматикасы мен телемеханикасы жүйелерін қауіпсіз пайдалану шарттары мен қағидалары	Условия и правила безопасной эксплуатации систем железнодорожной автоматики и телемеханики	Conditions and rules for the safe operation of railway automation and telemechanic systems
5	Көлік кәсіпорнын басқарудың зияткерлік жүйелерінің дамуы	Развитие интеллектуальных систем управления транспортным предприятием	Development of intelligent transport enterprise management systems
6	Сызықтық үздіксіз автоматика жүйелерін модельдеу принципі	Принцип моделирования линейных непрерывных систем автоматики	The principle of modeling linear continuous automation systems
7	Объектілерді және басқару жүйелерін	Методы идентификации объектов и систем управления	Methods of identification of objects and control

simplified two-wire and four-wire directional change circuits, the operation of the circuits in normal mode. Organizational and technical measures for the transition to two-way train traffic on one double-track stage, the principle of operation of the main circuit solutions

## **2.2. The perspective of the development of interval train control systems.**

Microprocessor-based auto-locking systems. General characteristics, block diagrams, basic equipment and its characteristics, the principle of operation of the system. Train traffic control systems based on axle counters and other promising elements. Advanced moving alarm and dispatch control systems.

### **Block 3**

#### **3.1. Control objects in technical systems.**

Classification of control objects in technical systems and their types, features of technical systems as control objects, linear and nonlinear models. Analytical and experimental methods for determining the static and dynamic characteristics of control objects. General provisions on information support of the management process. Principles of obtaining and converting technological information.

#### **3.2. Optimal controls in technical systems.**

The main methods for solving problems of modeling technical systems, an idea of the use of application software packages for modeling. Algorithms for optimizing static modes by directly searching for an extremum on the control object using a mathematical model. A comparative analysis of algorithms for optimizing static modes with a direct search for an extremum at the control object.

#### **4.4 Interview questions**

1. What are your academic strengths?
2. What are your academic shortcomings and how have you dealt with them?
3. What are your most significant scientific achievements to date?
4. What are your research interests?
5. What are your professional goals?
6. What attracted you to this field in the first place?
7. What is your motivation for obtaining this degree (PhD)?
8. What do you think significant trends in your field of research?
9. What interests you to want to participate in our program?
10. What do you consider your most significant achievement?
11. What are the goals and objectives of the automation industry?
12. What is the purpose of the railway automation and telemechanics industry?
13. What is the reliability of the system and its criteria?
14. What is the description of the terms automatic and automated?
15. What modern railway automation and telemechanics systems do you know?

#### **5. Recommended literature**

##### **5.1 Basic literature**

1. Glazunov L.P., Grabotsevskiy V.P., Fundamentals of the theory of reliability of automatic control systems: Moscow, Route, 2005 – 255 p.
2. Dudnikov E.G. Automatic control in industry / Textbook for universities of railway transport. – 3rd ed., reprint. and additional – M.: Transport, 2004. – 168 p.
3. Stefani E.P., Fundamentals of building automated process control systems M.: Energia, 2006. – 352s.
4. Cirlin A.M., Optimal control of technological processes, M.: Energoizdat 2006- 400 p.

5. Vasilkov Yu.V., Vasilkova N.N., Computer computing technologies in mathematical modeling: Moscow: Finance and Statistics, 2002 - 265 p.
6. Olson G., Piani D., Digital automation and control systems, St. Petersburg: Nevsky dialect, 2001- 557 p.
7. Kochetkov A.A. Remote control systems in railway transport, Moscow, Route, 2005 – 304 p.
8. Satyrev F.E., Golik V.K., Dispatch centralization "Neman", RB, Gomel, 2003 – 106 p.
9. Dolgiy I.D., Kulkin A.G., Dispatching control system and train traffic management DC – South with RCP, Rostov on Don, RGUPS, 2010 – 468 p.
10. Vinogradova V.Yu., Voronin V.A., Kazakov E.A., Shvalov D.V., Shukhina E.E. Distillation automation systems. Moscow, Route, 2005. – 292 p.
11. Fedorov N.E. Modern auto-locking systems with tonal rail circuits. Samara, SamGAPS, 2004. – 132 p.
12. Fedorov N.E. Relay and microelectronic systems of interval control of train movement. Samara, SamGAPS, 2006. – 163 p.

### **5.2 Additional literature**

1. Longbotov R.I., Reliability of computing systems: Moscow, Energia, 2001 – 216 p.
2. Shultz V.A., Methodological guidelines for the implementation of practical exercises. Almaty, KazATK 2010- 32s.
3. Shultz V.A., Textbook "Dispatch centralization". Almaty, KazATK 2010- 86c.
4. Technical operation of devices and systems of railway automation and telemechanics: a textbook / Edited by Doctor of Technical Sciences V.V. Sapozhnikov. - M: Route, 2003.- 335s.
5. Mankwein V.T., Frolov S.V., Shekhtman M.B., Application of Scada systems for automation of technological processes. Moscow: Tambov: Mechanical Engineering, 2000.- 176 p
6. Aristova N.I., Korneva A.A., Industrial software and hardware on the market of automated process control systems, M.: Nauktechizdat 2001.- 400 p .
7. Denisov A.A., Kolesnikov D.N., Theory of large control systems, L.: Energoizdat 2000- 228 p.
8. Vedernikov B.M. Automation and telemechanics on stages. A study guide. KazATK, Almaty, 2009. – 109 p.
9. Vedernikov B.M. Automatic and semi-automatic locking. A study guide. KazATK, Almaty, 2009. – 132 p.
10. Vedernikov B.M. Travel sensors. A study guide. KazATK, Almaty, 2011. – 122 p.
11. Vedernikov B.M. Signal auto-regulation. Almaty, KazATK, 2009. – 92 p.
12. Vedernikov B.M. Automatic fencing devices on stages. Almaty, KazATK, 2008. – 100 p.
13. Vedernikov B.M. Methodological guidelines for practical classes in the discipline "Interval train control systems" (for undergraduates of the specialty 6M070200 – Automation and control). Almaty, KazATK, 2010. – 44 p.
14. Vedernikov B.M. Methodological guidelines for the independent work of a graduate student under the guidance of a teacher in the discipline "Systems of interval regulation of train traffic". Almaty, KazATK, 2010. – 40 p.