«Mukhametzhan Tynyshbayev ALT University» JSC

I APPROVE
Chairman of the «ALT University» JSC
_____ M. Zharmagambetova

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
«D099 – Energy and electrical engineering»

Almaty, 2025

The program of the entrance exam was discussed and received a positive decision at the meeting of the Department of «Energy», Protocol №8 of April 16, 2025.

Head of the Department of «Energy» _____ **A.Egzekova**

The program of the entrance exam was reviewed and recommended at the meeting of the Council of the Institute «Energy and Digital Technologies», Protocol № 5 of April 25, 2025.

Chairman of CI «EDT» _____ **A.Toygozhinova**

CONTENT

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 preparedness of an applicant for doctoral studies, the level of knowledge, skills and abilities compliance with the requirements of doctoral studies in the field of study.

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 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 essay writing is 20 points, an exam on the profile of the state educational program is 50 points, and an 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)	Atleast 250words
Scientificand 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	4
	one's own point of view (position, attitude) is presented when disclosing the problem	4
Argumentation, evidence base 3 points	the presence of arguments from scientific literature and sources corresponding to the topic of the essay	4

Compositional integrity and logic of presentation 2 points	the presence of compositional integrity, the structural components of the essay are logically connected	4
Speech culture 2 points	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**	**Numberofpoints**
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**
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.	5
Maximum number of points			**30**

4. Content of examination materials

4.1 Contents of the Essay Topic

№	Essay Topic
1	Features of the Development of Electric Power Industry in the Republic of Kazakhstan
2	How Do You Assess the Prospects for the Development of Innovation in the Electric Power Sector?
3	Automated Integrated Installations for Testing Electrical Equipment Insulation
4	Prospects for the Development of Renewable Energy Sources in Kazakhstan
5	Integrated Automated Systems for Monitoring and Diagnostics of Electrical Equipment
6	Features of Designing Digital Substations under the Conditions of the Republic of Kazakhstan
7	Relevance and Prospects of Digital Technology Implementation in the Electric Power Sector
8	Relevance of Implementing Automated Systems to Improve Power Quality Indicators
9	Modeling and management of distribution network operating modes with active participation of consumers (Prosumers) and development of Smart Grid technologies.
10	Research of methods for increasing the capacity of existing power transmission lines using FACTS technologies and real-time monitoring systems.

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 «D099 – Energy and electrical engineering»

№	Name of disciplines
1	Electrical networks and systems
2	Electrical stations and substations
3	Relay protection and automation in power supply systems

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

Block 1

Designs of electrical network lines. Characteristics and parameters of the elements of the electrical power system. Operating modes of electrical power systems. Electromechanical systems of electrical devices. Heating and cooling of electrical devices. Switching electrical circuits. Electrodynamic forces in electrical devices. Electrical contacts. Low and high voltage switchgear devices.

Block 2

Electrical machines of direct and alternating current. High voltage insulation. Overvoltage and protection against it. Purpose of relay protection and automation in power supply systems. Elements of relay protection and automation devices. Operating principle of automatic restart.

Operating principle of automatic switching on of the reserve. Protection and automation of station elements, substations and electricity consumers.

Block 3

Protection and automation of power lines. Current directional protection. Distance protection. Differential current protection. Reliability of power plants and substations. Reliability of power lines. Non-traditional renewable energy sources. Energy of sun. Wind energy. Geothermal energy. General issues of electromagnetic compatibility. Sources of electromagnetic interference. Mechanisms of interference and measures to reduce it. Non-sinusoidal power supply modes. Voltage asymmetry in power supply systems. Dynamic characteristics of power quality indicators.

4.4 Interview questions

1. Why did you decide to pursue a PhD in electrical power engineering?
2. What are your long-term career goals after receiving your PhD?
3. Why did you choose our university/research group to enroll in?
4. What specific scientific problems in modern electrical power engineering concern you the most and why?
5. How do you see the contribution of your future research to the development of electrical power engineering?
6. What can you, for your part, give to our educational institution if you are admitted?
7. Describe your research (or significant project). What were the key objectives, methods, results and your personal contribution?
8. What were the main challenges you encountered during your previous research/project and how did you overcome them?
9. What modeling, data analysis or experimental techniques did you use in your previous work (e.g. MATLAB/Simulink, PowerFactory/DIgSILENT, Python, EMTP-RV, laboratory benches)?
10. Do you have experience publishing scientific articles, presenting at conferences? If yes, please tell us about it. If no, how do you plan to develop these skills?
11. Describe your experience of working with scientific literature. How do you search for relevant publications and critically evaluate them?
12. Describe your preliminary vision of the topic of your doctoral research. What are the key goals and hypotheses?
13. How do you see the scientific novelty of your proposed research?
14. What, in your opinion, are the most critical challenges facing the modern electric power industry (at the level of the UPS, distribution networks, energy markets, etc.)?
15. What are your most important strengths for successful completion of your PhD? What areas would you like to improve during your studies?

5. Recommended literature

5.1 Basic literature

1. Лыкин Л.В. Электрические системы и сети. Учебник для СПО, 2019. -362с.
2. И. Г. Карапетян, Д. Л. Файбисович, И. М. Шапиро. Справочник по проектированию электрических сетей. Под ред. Файбисовича Д.Л. - 4-е издание. - М.: изд-во НЦ ЭНАС, 2012. - 376с.
3. Рожкова Л.Д., Карнеева Л.К., Чиркова Т.В. Электрооборудование электрических станций и подстанций. Издательский центр «Академия», 2013. -449с.

4. А. И. Гринь, Х. М. Мустафаев. Электрическая часть станций и подстанций. Учебное пособие, Ставрополь, 2002.

5. Алиев, И.И. Электрические машины / И.И. Алиев. - Вологда: Инфра-Инженерия, 2014. - 448 с.

6. Кацман, М.М. Электрические машины: Учебник / М.М. Кацман. - М.: Academia, 2017. - 320с.

7. Александров Г.Н. Электрические аппараты высокого напряжения. / Г.Н. Александров и др. Под редакцией Г.Н. Александрова. – Изд. 2-е. – СПб.: Изд-во СПбГТУ, 2000. – 503с.

8. Электрические и электронные аппараты./ П.А. Курбатов и др. Под редакцией П.А. Курбатова. - Москва.: Издательство Юрайт, 2016.- 440с.

9. Важов, В. Ф. Техника высоких напряжений: учебник / В.Ф. Важов, В.А. Лавринович. – Москва.: ИНФРА-М, 2018. - 262 с.

10. Киреева, Э. А. Релейная защита и автоматика электроэнергетических систем: учебник. / Э. А. Киреева, С. А. Цырук. - 5-е изд. – Москва.: Академия, 2016. - 287 с.

11. Андреев В.А. Релейная защита и автоматика систем электроснабжения. – 4-е изд., перераб и доп. – М.: Высшая школа, 2006. -639с.

12. Цыганков В.М. Надежность электрических систем и сетей. – Минск: БНТУ, 2001.-150с.

13. Возобновляемые источники электроэнергии: учебное пособие / Б.В. Лукутин. – Томск: Изд-во Томского политехнического университета, 2008. – 187 с.

14. Городов Р.В. Нетрадиционные и возобновляемые источники энергии: учебное пособие / Р.В. Городов, В.Е. Губин, А.С.Матвеев. - 1-е изд. - Томск: Изд-во Томского политехнического университета, 2009. - 294 с.

15. Харлов Н.Н. Электромагнитная совместимость в электроэнергетике: Учебное пособие. – Томск: Изд-во ТПУ, 2007. – 207 с.

16. Овсянников А. Г. Электромагнитная совместимость в электроэнергетике: учебник / Овсянников А. Г. Борисов Р.К. - Новосибирск : Изд-во НГТУ, 2017. - 196 с.

17. Волков Н.Г. Качества электроэнергии в системах электроснабжения. Томск: Томский политехнический университет, 2010. -152с.

18. Климова Г.Н. Электроэнергетические системы и сети. Энергосбережение: учебное пособие для вузов/ Г.Н. Климова. - 2-е изд. – Москва.: Издательство Юрайт, 2020. – 179 с.

5.2 Additional literature

1. Идельчик В.И. Электрические системы и сети: Учебник для вузов. - М.: Энергоатомиздат, 1989. - 592 с.: ил.

2. Стерман Л.С., Лавыгин В.М., Тишин С.Г. Тепловые и атомные электрические станции: Учебник для вузов. - М.: Издательство МЭИ,

3. Афонин, В.В. Электрические станции и подстанции: учебное пособие в 2 частях / В.В. Афонин, К.А. Набатов. – Тамбов.: Тамбовский государственный технический университет, 2017. – Ч. 2. – 98 с.

4. Копылов, И.П. Электрические машины в 2 т. том 1: Учебник для академического бакалавриата / И.П. Копылов. - Люберцы: Юрайт, 2016. - 267 с.

5. Копылов, И.П. Электрические машины в 2 т. том 2: Учебник для академического бакалавриата / И.П. Копылов. - Люберцы: Юрайт, 2016. - 407 с.

6. Москаленко, В.В. Электрические машины и приводы: Учебник / В.В. Москаленко. - М.: Академия, 2018. - 128 с.

7. Техника высоких напряжений./ И.М. Богатенков, Ю.Н. Бочаров, Н.И. Гумерова, Г.М. Иманов и др. Под ред. Г.С. Кучинского. - СПб.: Энергоатомиздат, 2003. – 608 с.

8. Лукутин Б.В. Возобновляемая энергетика в децентрализованном электроснабжении / Б.В. Лукутин, О.А. Суржикова., Е.Б. Шандрова. - М.: Энергоатомиздат, 2008. - 231 с.

9. Дьяков А.Ф., Максимов Б.К., Борисов Р.К., Кужекин И.П., Жуков А.В. Электромагнитная совместимость в эдектроэнергетике и электротехеике./ Под ред. А.Ф. Дьякова. -М.: Энергоатомиздат, 2003. -768 с.

10. Овсянников, А.Г. Электромагнитная совместимость в электроэнергетике: учебник / А.Г. Овсянников, Р.К. Борисов. – Новосибирск: Новосибирский государственный технический университет, 2011. – 194 с.

11. Мельников М.А. Релейная защита и автоматика элементов систем электроснабжения промышленных предприятий: учебное пособие / М.А. Мельников-Томский политехнический университет. - Томск: Изд-во ТПУ, 2008. - 218 с.

12. Бутенко В.А. Техника высоких напряжений: учебное пособие / В.А. Бутенко, В.Ф. Важов, Ю.И. Кузнецов, Г.Е. Куртенков, В.А. Лавринович, А.В. Мытников, М.Т. Пичугина, Е.В. Старцева. - Томск: Изд-во ТПУ, 2008. - 119 с.