JSC "ALT University named after Mukhamedzhan Tynyshpaev"

APPROVED
Chairperson of the Academic Council
of ALT University
_____ M.S. Zharmagambetova
Decision of the Academic Council
of ALT University
dated "30" 04 2026
(Minutes No. 8)

ENTRANCE EXAMINATION PROGRAM
for Admission to the Doctoral Program
Scientific and Pedagogical Track

8D07160 – Electric Power Engineering (Scientific and Pedagogical Track)

D099 – Energy and electrical engineering

Алматы 2026 г.

The Entrance Examination Program was discussed and approved at the meeting of the Department of Energy.
Minutes No 8 dated "28" 04 2026.

Acting Head of the Department _____ **G.P. Kalimbetov**

The Entrance Examination Program was reviewed and recommended at the meeting of the Council of the Institute of Energy and Digital Technologies.
Minutes No. 9 dated "30" 04 2026.

Chairperson of the Council of the Institute of Energy and Digital Technologies _____ **A.Zh. Toygozhinova**

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1. PURPOSE OF THE ENTRANCE EXAMINATION

The purpose of the entrance examination is to assess the applicant's level of theoretical and practical preparation, as well as to determine whether the applicant's knowledge, skills, and competencies meet the requirements of the doctoral education program in the chosen field of study.

The entrance examination for admission to the PhD Doctor of Philosophy program consists of the following components:

1. Interview conducted by the Examination Committee;
2. Essay writing;
3. Responses to examination questions in the profile of the educational program group.

2. ENTRANCE EXAMINATION FORMAT AND PROCEDURES

The total duration of the entrance examination is 3 hours and 30 minutes. During this time, the applicant undergoes an interview, writes an essay, and answers three questions contained in an electronic examination ticket.

The essay topic and the examination questions are generated by random selection.

The maximum score for the entrance examination is 100 points, including:

- Essay – 20 points;
- Profile examination in the educational program group – 50 points;
- Interview – 30 points.

3. TYPES OF ASSESSMENT AND EVALUATION CRITERIA

3.1 Essay Evaluation Criteria

Essay Type	Description	Essay Length
Motivational Essay	Justification of the applicant's motivation to engage in research activities (*research statement*)	**At least 250 words**
Scientific and Analytical Essay	Justification of the relevance and methodology of the proposed research (*research proposal*)	
Problem-Oriented Essay	Presentation of the author's position on current issues in the relevant field of knowledge	

Essay Evaluation Criteria

Criteria	Descriptors	Points
Depth of Topic Coverage	The topic is disclosed at a theoretical level with the correct use of scientific terminology and concepts.	4
	The essay presents the author's own viewpoint (position, opinion) on the issue.	4
Argumentation and Justification	Scientific evidence and references relevant to the essay topic are provided.	4
Structural Integrity and Logical Consistency	The essay demonstrates a coherent composition, and all structural elements are logically interconnected.	4
Language Proficiency	Demonstrates a high level of academic writing skills (vocabulary, command of scientific terminology, grammar, and academic style)	4

Criteria	Descriptors	Points
Maximum Score		20

3.2 Evaluation Criteria for Responses to the Electronic Examination Ticket Questions

The profile examination for the educational program group consists of three blocks, including:

- **Question 1** – assesses the level and systematic nature of theoretical knowledge;
- **Question 2** – assesses the level of functional competencies;
- **Question 3** – assesses systemic competencies.

Maximum score – 50 points.

The electronic examination ticket contains three questions:

Block	Question Description	Points
Question 1	**Theoretical** – assesses the level and systematic nature of theoretical knowledge	**10**
Question 2	**Practical** – assesses the level of functional competencies (ability to apply methods, technologies, and approaches within the subject area)	**20**
Question 3	Assesses a systematic understanding of the subject area and specialized knowledge of research methodology (systemic competencies)	**20**
Total		**50**

Evaluation Criteria for Responses to the Electronic Examination Ticket Questions

Question	Evaluation Criteria	Points
Question 1	Demonstrates knowledge of the fundamental processes within the relevant subject area; provides a comprehensive and in-depth answer.	**5**
	Expresses opinions logically and consistently regarding the issue under discussion.	**3**
	Demonstrates mastery of conceptual terminology and scientific vocabulary.	**2**
Total		**10**
Question 2	Applies appropriate methods, techniques, and technologies to solve problems in the relevant subject area.	**7**
	Justifies, compares, and classifies phenomena, events, and processes; draws conclusions and makes generalizations based on practical skills.	**7**
	Analyzes information obtained from various sources.	**6**
Total		**20**
Question 3	Critically analyzes and evaluates theoretical and practical developments, scientific concepts, and current trends in the developmentof science	**7**
	Integrates methodological approaches in explaining the key issues of the subject area.	**7**
	Identifies cause-and-effect relationships in the analysis of processes, phenomena, and events.	**6**
Total		**20**

GRAND TOTAL – 50 points

3.3 Interview Evaluation Criteria

No.	Criteria	Descriptors	Points
1	**Motivation**	Justifies the motivation for pursuing doctoral studies in the selected educational program and at the chosen university. Clearly identifies professional and personal development prospects after completing the doctoral program.	**5**
2	**Research Competence**	Demonstrates research skills and experience required for conducting scientific research within the relevant subject area.	**10**
3	**Creativity**	Demonstrates originality of thinking, creative approaches, and the ability to propose alternative solutions to scientific problems and situational tasks.	**10**
4	**Communication Competence**	Expresses ideas clearly, concisely, logically, and persuasively; is able to formulate conclusions and demonstrate language proficiency.	**5**

Maximum score – 30 points

4. CONTENT OF THE EXAMINATION MATERIALS

4.1 Essay Topics

No.	Essay Topics
1	Problems of electricity shortages in the regions: relevance and development prospects for ensuring the country's energy security.
2	Analysis and diagnostics of overhead and cable transmission lines based on the characteristics of partial discharges.
3	Prospects for the development of railway electrification in the Republic of Kazakhstan under conditions of electricity shortage.
4	Analysis of switchgear current-carrying components based on non-contact temperature measurement.
5	AC/DC uninterruptible power supply systems: challenges, advantages, and disadvantages.
6	Relevance of alternative energy development in Kazakhstan: challenges and prospects.
7	Trends in innovative development within the energy sector.
8	Describe the types of auxiliary systems used in 110/10 kV, 220/10 kV, 35/10 kV and other power transformers.
9	Main directions for the development of relay protection and automation.
10	Describe the area of your scientific research and research interests. How do you envision your scientific and academic career after completing the doctoral program? Do you have any scientific publications in this field?

4.2 Content of the Entrance Examination

The entrance examination materials for the doctoral program in the educational program group 8D07160 – Electric Power Engineering (Scientific and Pedagogical), including essay topics and profile examination questions, are prepared in Kazakh, Russian, and English. The examination

questions correspond to selected sections of the curriculum of the educational program group 8D07160 – Electric Power Engineering (Scientific and Pedagogical).

No.	Course Title
1	Electric Power Systems and Networks
2	Power Plants and Substations
3	Relay Protection and Automation of Power Supply Systems
4	Alternative Energy Sources

4.3 Content of the Examination Sections by Block

Block 1. Electric Power Systems and Electrical Apparatus
Content:
Main components and configurations of electric power transmission lines. Parameters and characteristics of electric power systems. Normal and emergency operating conditions of electric power systems. Electromechanical systems of electrical apparatus. Thermal processes in electrical apparatus. Switching processes in electrical circuits. Electrodynamic effects in electrical apparatus. Electrical contacts and contact connections. Electrical apparatus used in low-voltage and high-voltage switchgear. DC and AC electrical machines. High-voltage insulation. Overvoltages in electrical networks and methods of protection against them.

Block 2. Electrical Equipment and Switchgear
Content:
Indoor and outdoor switchgear (GIS and AIS). Storage batteries and DC auxiliary power systems. Materials used in electrical engineering. Design of power transformers: magnetic core, windings, tank, and auxiliary equipment. Operating principles of power transformers. Autotransformers, their characteristics, advantages, and fields of application. Electric arc and methods of arc extinction. Low-voltage electrical apparatus, their purpose, design, and operating characteristics.

Block 3. Relay Protection, Automation, and Reliability of Electric Power Systems
Content:
Purpose and objectives of relay protection and automation. Basic components of relay protection systems. Principles of Automatic Reclosing (AR) and Automatic Transfer Switching (ATS). Protection and automation of power plants, substations, and electricity consumers. Relay protection of transmission lines. Directional overcurrent, distance, and differential protection schemes. Reliability of power plants, substations, and electric transmission lines. Modern microprocessor-based relay protection and automation devices.

Block 4. Renewable and Alternative Energy Sources
Content:
Current state and development prospects of renewable energy. Types of alternative energy sources: solar, wind, hydropower, geothermal, bioenergy, and hydrogen energy. Principles of energy conversion in photovoltaic and wind power systems. Main components of solar and wind power plants. Electrical energy storage systems. Integration of renewable energy sources into electric power systems. Hybrid energy systems. Environmental and economic aspects of the use of alternative energy sources. Modern technologies for managing renewable energy facilities and Smart Grid systems.

4.4 INTERVIEW QUESTIONS

1. What motivated you to continue your studies in the doctoral program in Electric Power Engineering?
2. What are your professional and research goals after completing the doctoral program and obtaining a PhD degree?
3. Why did you choose our University and this educational program to pursue your doctoral studies?
4. In your opinion, which current scientific and engineering challenges in the field of electric power engineering require priority attention, and why are you interested in them?
5. In your opinion, what practical and scientific contribution can your doctoral research make to the development of electric power engineering?
6. What knowledge, professional experience, and research potential are you prepared to contribute to the University's academic and research activities?
7. Please describe the most significant research project, engineering project, or graduation thesis in which you have participated. What were the objectives of the research, the methods used, the results obtained, and your personal contribution?
8. What scientific, technical, or organizational challenges did you encounter while conducting your previous research (or project)? What approaches did you use to overcome them?
9. Which software packages, simulation tools, data analysis methods, or laboratory equipment are you proficient in? Do you have experience working with MATLAB/Simulink, DIgSILENT PowerFactory, ETAP, PSCAD, EMTP-RV, Python, SCADA systems, or laboratory equipment?
10. Do you have experience preparing scientific publications or participating in conferences, scientific seminars, or research project competitions? What achievements have you obtained? If you do not yet have such experience, how do you plan to develop your research competencies?
11. How do you search for, analyze, and critically evaluate contemporary scientific literature? Which scientific databases and information resources do you use in your research?
12. Which research area do you consider to be the priority topic for your doctoral dissertation? What are the proposed objective, research tasks, object, subject, and working hypothesis of your study?
13. In your opinion, what will be the scientific novelty and practical significance of the proposed research?
14. Which major challenges and development trends in modern electric power engineering (digitalization, Smart Grid technologies, integration of renewable energy sources, cybersecurity, decarbonization, improvement of power system reliability, energy storage systems, etc.) do you consider the most relevant?
15. Which personal qualities, professional competencies, and research skills will help you successfully complete the doctoral program? Which competencies do you plan to develop during your doctoral studies?

5. RECOMMENDED LITERATURE

5.1 Core Literature

1. Lykin L.V. Electric Power Systems and Networks. Textbook for Technical and Vocational Education Institutions, 2019. – 362 p.
2. Karapetyan I.G., Faybisovich D.L., Shapiro I.M. Handbook for Electrical Network Design. Edited by D.L. Faybisovich. 4th Edition. Moscow: NC ENAS Publishing House, 2012. – 376 p.
3. Rozhkova L.D., Karneeva L.K., Chirkova T.V. Electrical Equipment of Power Plants and Substations. Academy Publishing Center, 2013. – 449 p.

4. Grin A.I., Mustafayev Kh.M. Electrical Part of Power Plants and Substations. Study Guide. Stavropol, 2002.
5. Aliyev I.I. Electrical Machines. Vologda: Infra-Inzheneriya, 2014. – 448 p.
6. Katsman M.M. Electrical Machines. Textbook. Moscow: Academia Publishing Center, 2017. – 320 p.
7. Aleksandrov G.N. et al. High-Voltage Electrical Apparatus. Edited by G.N. Aleksandrov. 2nd Edition. Saint Petersburg: Saint Petersburg State Technical University Publishing House, 2000. – 503 p.
8. Kurbatov P.A. et al. Electrical and Electronic Apparatus. Edited by P.A. Kurbatov. Moscow: Yurait Publishing House, 2016. – 440 p.
9. Vazhov V.F., Lavrinovich V.A. High Voltage Engineering. Textbook. Moscow: INFRA-M, 2018. – 262 p.
10. Kireeva E.A., Tsyruk S.A. Relay Protection and Automation of Electric Power Systems. 5th Edition. Moscow: Academia Publishing Center, 2016. – 287 p.
11. Andreev V.A. Relay Protection and Automation of Power Supply Systems. 4th Edition, revised and expanded. Moscow: Vysshaya Shkola, 2006. – 639 p.
12. Tsygankov V.M. Reliability of Electric Power Systems and Networks. Minsk: Belarusian National Technical University, 2001. – 150 p.
13. Lukutin B.V. Renewable Sources of Electrical Energy. Study Guide. Tomsk: Tomsk Polytechnic University Publishing House, 2008. – 187 p.
14. Gorodov R.V., Gubin V.E., Matveev A.S. Non-Traditional and Renewable Energy Sources. Study Guide. 1st Edition. Tomsk: Tomsk Polytechnic University Publishing House, 2009. – 294 p.
15. Kharlov N.N. Electromagnetic Compatibility in Electric Power Engineering. Study Guide. Tomsk: Tomsk Polytechnic University Publishing House, 2007. – 207 p.
16. Ovsyannikov A.G., Borisov R.K. Electromagnetic Compatibility in Electric Power Engineering. Textbook. Novosibirsk: Novosibirsk State Technical University Publishing House, 2017. – 196 p.
17. Volkov N.G. Power Quality in Electric Power Supply Systems. Tomsk: Tomsk Polytechnic University, 2010. – 152 p.
18. Klimova G.N. Electric Power Systems and Networks. Energy Conservation. Study Guide for Higher Education Institutions. 2nd Edition. Moscow: Yurait Publishing House, 2020. – 179 p.

5.2 Additional Literature

1. Idelchik V.I. Electric Power Systems and Networks. Textbook for Higher Education Institutions. Moscow: Energoatomizdat, 1989. – 592 p., ill.
2. Sterman L.S., Lavygin V.M., Tishin S.G. Thermal and Nuclear Power Plants. Textbook for Higher Education Institutions. Moscow: Moscow Power Engineering Institute (MPEI) Publishing House.
3. Afonin V.V., Nabatov K.A. Power Plants and Substations. Study Guide in Two Parts. Tambov: Tambov State Technical University, 2017. Part 2. – 98 p.
4. Kopylov I.P. Electrical Machines. In 2 Volumes. Volume 1. Textbook for Academic Bachelor's Degree Programs. Lyubertsy: Yurait Publishing House, 2016. – 267 p.
5. Kopylov I.P. Electrical Machines. In 2 Volumes. Volume 2. Textbook for Academic Bachelor's Degree Programs. Lyubertsy: Yurait Publishing House, 2016. – 407 p.
6. Moskalenko V.V. Electrical Machines and Electric Drives. Textbook. Moscow: Academia Publishing Center, 2018. – 128 p.
7. Bogatenkov I.M., Bocharov Yu.N., Gumerova N.I., Imanov G.M., et al. High Voltage Engineering. Edited by G.S. Kuchinsky. Saint Petersburg: Energoatomizdat, 2003. – 608 p.
8. Lukutin B.V., Surzhikova O.A., Shandrova E.B. Renewable Energy in Decentralized Power Supply Systems. Moscow: Energoatomizdat, 2008. – 231 p.

9. Dyakov A.F., Maksimov B.K., Borisov R.K., Kuzhekin I.P., Zhukov A.V. Electromagnetic Compatibility in Electric Power Engineering and Electrical Engineering. Edited by A.F. Dyakov. Moscow: Energoatomizdat, 2003. – 768 p.
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11. Melnikov M.A. Relay Protection and Automation of Industrial Power Supply System Components. Study Guide. Tomsk Polytechnic University. Tomsk: Tomsk Polytechnic University Publishing House, 2008. – 218 p.
12. Butenko V.A., Vazhov V.F., Kuznetsov Yu.I., Kurtenkov G.E., Lavrinovich V.A., Mytnikov A.V., Pichugina M.T., Startseva E.V. High Voltage Engineering. Study Guide. Tomsk: Tomsk Polytechnic University Publishing House, 2008. – 119 p.