

NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"Igor Sikorsky Kyiv Polytechnic Institute"

FACULTY OF ELECTRIC POWER ENGINEERING AND AUTOMATICS

APPROVED by
Academic Council of
Faculty of electric power engineering and automatics
Protocol No. ____ from February 26, 2020

Chairman of the Academic Council

_____ Olexandr YANDULSKY

PROGRAM

of additional examination

for admission of foreign citizens to master's degree program
"Electrotechnical devices and electrotechnological complexes"
specialty 141 *Electric power engineering, electrical engineering and electromechanics*

The program is recommended by
Department of theoretical electrical engineering
Protocol No. 6 from January 22, 2020

Head of Department

_____ Mykola OSTROVERKHOV

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INTRODUCTION

Additional examination for admission to the master's degree program "Electrotechnical devices and electrotechnological complexes" according to specialty 141 *Electric power engineering, electrical engineering and electromechanics* is aimed at revealing knowledge and skills in educational program for further training.

The test takes place in the form of a written work lasting 1 hour 30 minutes. Each examination task has three theoretical questions on the main courses of educational program. After writing the work, the commission checks them and gives ratings in accordance with the evaluation criterion.

MAIN PART

1. Theoretical fundamentals of electrical engineering

1. Charged elementary particles and the electromagnetic field as special types of matter.
2. The relationship between electrical and magnetic phenomena. Electric and magnetic fields as two sides of a single electromagnetic field.
3. The relationship of the charge of particles and bodies with their electric field. Gauss theorem.
4. Polarization of substances. Electrical displacement. Maxwell's postulate.
5. Electric currents of conductivity, transfer and bias.
6. The principle of continuity of electric current.
7. Electrical voltage. Electric potential difference. Electromotive force.
8. Magnetic flux. The principle of magnetic flux continuity.
9. The law of electromagnetic induction.
10. Stream linking. Electromotive force of self-induction and mutual induction. The principle of electromagnetic inertia.
11. Potential and vortex electric fields.
12. The relationship of the magnetic field with electric current.
13. The magnetization of matter and magnetic field intensity.
14. The law of total current.
15. The basic equations of the electromagnetic field.
16. The energy of the system of charged bodies. The distribution of energy in an electric field.
17. Energy system circuits with electric currents. The distribution of energy in a magnetic field.
18. Forces acting on charged bodies.
19. Electromagnetic force.
20. Definition of the basic concepts of the theory of electric circuits: electric current, voltage, potential, energy, power.

2. Electrical apparatus

21. Define the term "electrical apparatus". How are electrical appliances classified by purpose? How are electrical appliances classified by working principle?
22. What groups are divided into electrical devices by the degree of protection from the environment? What groups of electric devices are distinguished by their method actions?
23. Formulate the basic requirements for electric apparatus.
24. What are the degrees of protection against personnel touching hazardous parts?

25. What are the main materials used for making contacts. What is "bimetal" and how is it used in electrical designs apparatuses?
26. How is the active resistance of a conductor determined? What is the surface effect? Explain the phenomenon of proximity effect?
27. What are eddy currents, how to deal with them.
28. What are the main types of heat transfer and give them a characteristic. Define thermal conductivity and name its main characteristics.
29. Give a definition of convection and what are its main characteristics. Define thermal radiation and what are its main characteristics.
30. What is the heat transfer coefficient, what are its main characteristics?
31. Explain the process of heating the conductor in the steady state operation of the electrical apparatus.
32. Explain the features of the process of heating the conductor during a short circuit.
33. Explain the features of the process of cooling the conductor during a short circuit.
34. Explain the features of the heating process of the coils of electrical apparatus. What is thermal stability?
35. Explain the features of the liquid cooling process of live parts of electrical apparatus.
36. Define the term "electrical contact". What are the main types of contacts, depending on the form of contact.
37. Classification of contacts by appointment. How are single-stage and multi-stage contact systems constructed constructively?
38. What are the contact nodes for small tripping currents? What are the contact nodes for medium and high tripping currents?
39. Describe the term "contact resistance" and give its definition. How does the contact resistance of a contact depend on temperature?
40. Give the main types of designs of contact joints. What are the main requirements for contact switching systems?

3. High voltage engineering

41. Methods of neutral grounding. General characteristics of electrical networks and grounded neutral. General characteristics of isolated neutral networks.
42. General characteristics of the external insulation of electrical installations.
43. General characteristics of the internal insulation of electrical installations.
44. Corona discharge on the wires of overhead power lines. Corona discharge characteristics.
45. Energy losses due to corona discharge and radio interference.
46. Voltage-time insulation characteristic.
47. Type of voltage-time characteristics for gaps with a uniform and non-uniform field.
48. General characteristic of solid insulation. Dielectric strength of solid insulation.
49. General characteristics of gas insulation. The use of gas-insulated insulation.
50. General characteristics of overhead power line insulators.
51. Purpose and design features of linear pin insulators.
52. Purpose and design features of linear suspension insulators.
53. Suspension insulator strings.
54. An equivalent circuit of a string of insulators and a voltage distribution along a string of insulators.
55. Protective fittings for suspension insulator strings.
56. Comparative analysis of glass, porcelain and polymer insulators.
57. Purpose and features of the design of rod suspension insulators.
58. Air insulation gaps in power lines.

59. Purpose and design features of supporting insulators.
 60. Purpose and design features of pin support insulators.

FINAL PART

EVALUATION CRITERIA FOR ADDITIONAL EXAMINATION

On the exam, students perform a written test. Each task contains three theoretical questions. The first question is estimated at 34 points, the second and the third - 33 points.

The evaluation system of the first theoretical question:

- “excellent”, full answer (at least 90% of the required information) - 32-34 points
- “very good”, a fairly complete answer (at least 85% of the required information), or a complete answer with minor inaccuracies - 29-31 points
- “good”, a fairly complete answer (at least 75% of the required information) with the inaccuracies present - 25–28 points
- “satisfactory”, incomplete answer (at least 65% of the required information) and minor errors - 22-24 points
- “enough”, incomplete answer (at least 60% of the necessary information) and minor errors - 20-21 points
- “unsatisfactory”, unsatisfactory answer (less than 60% of the required information), or contains significant errors - 0 points.

The evaluation system of the second and third theoretical questions:

- “excellent”, full answer (at least 90% of the required information) - 32-33 points
- “very good”, a fairly complete answer (at least 85% of the required information), or a complete answer with minor inaccuracies - 28-31 points
- “good”, a fairly complete answer (at least 75% of the necessary information) with inaccuracies - 24-27 points
- “satisfactory”, incomplete answer (at least 65% of the required information) and minor errors - 22-23 points
- “sufficient”, incomplete answer (at least 60% of the necessary information) and minor errors - 19-21 points
- “unsatisfactory”, unsatisfactory answer (less than 60% of the required information), or contains significant errors - 0 points.

The sum of the points for three questions is transferred to the examination score according to the table:

Number of points	Assessment
95-100	Excellent
85-94	Wery good
75-84	Good
65-74	Satisfactory
60-64	Sufficient
Less than 60	Unsatisfactory

EXAMPLE OF A TYPICAL ADDITIONAL EXAMINATION TASK

1. Definition of the basic concepts of the theory of electric circuits: electric current, voltage, potential, energy, power.

2. Give the main types of designs of contact joints. What are the main requirements for contact switching systems?
3. Purpose and design features of pin support insulators.

RECOMMENDED LITERATURE LIST

1. Theoretical fundamentals of electrical engineering. Vol 1: Textbook for students of electrical engineering specialties of universities / V.S. Boiko [et al.]; Ed. by I. M. Chizhenko, V.S. Boiko; NTUU "KPI". - Kiev: Polytechnica, 2004. - 272 p.
2. Theoretical fundamentals of electrical engineering. Vol 2: Textbook for students of electrical engineering specialties of universities / V.S. Boiko [et al.]; Ed. by I. M. Chizhenko, V.S. Boiko; NTUU "KPI". - Kiev: Polytechnica, 2008. - 224 p.
3. Theoretical fundamentals of electrical engineering. Vol 2: Textbook for students of electrical engineering specialties of universities / V.S. Boiko [et al.]; Ed. by I. M. Chizhenko, V.S. Boiko; NTUU "KPI". - Kiev: Polytechnica, 2013. - 241 p.
4. V. A. Brzezitsky, V. Ts. Zelinsky, P. D. Lezhniuk, A. E. Rubanenko. Electric devices: a textbook / [Brzezitsky V. A., Zelinsky V. Ts., Lezhniuk P. D., Rubanenko A. E.]. - Kherson: OLDI-PLUS, 2016. -- 602 p..
5. Brzezitsky V. A., Isakova A. V., Rudakov V. V. et al. High-voltage engineering and electrophysics: Textbook. / Ed. V. A. Brzezitsky and V. M. Mikhailov. - Kharkiv: NTU "KhPI" - Tornado, 2005. - 930 p.
6. Jerusalimov M.E., Orlov N.N. High-voltage engineering / Edited by M.E. Jerusalimov. - Kiev: Kiev University Press, 1967. - 444 p.

Program developed by

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