

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution for Higher Education
«North-Caucasus Federal University»

APPROVED BY

Dean of FPE of NCFU

Candidate of Technical Sciences,

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ASSESSMENT TOOLS FOR THE DISCIPLINE (MODULE)
« Theory of Electrical Networks »

Field of study	<u>13.04.02 Electric Power Engineering and Electrical Engineering</u>
Specialization (Profile)	<u>Training Program of Electrical Engineering</u>
Year of commencement of studies	<u>2026</u>
Mode of study	<u>full-time</u>
Implemented in semester(s)	<u>2</u>

Foreword

1. Purpose: This assessment tools (AT) document is intended to assess the level of competency formation during ongoing progress control and intermediate assessment of students in the discipline " Theory of Electrical Networks ".

2. The AT is an appendix to the syllabus of the discipline " Theory of Electrical Networks ".

3. Developer: Candidate of Technical Sciences, Associate Professor of the Department of Automated Electric Power Systems and Power Supply, D.A. Kostyukov

4. The AT has undergone expert review.

Members of the expert group:

Chairperson: Yu. G. Kononov, Doctor of Technical Sciences, Professor, Head of the Department of Automated Electric Power Systems and Power Supply.

Committee members:

D.A. Kostyukov, Candidate of Technical Sciences, Associate Professor, Department of Automated Electric Power Systems and Power Supply.

A.V. Petrov, Candidate of Technical Sciences, Associate Professor, Department of Automated Electric Power Systems and Power Supply.

Representative of the employer organization:

S.A. Filippov, Candidate of Technical Sciences, Head of the Leninsky District Department of the Stavropol Interdistrict Branch of the PJSC «Stavropolenergosbyt».

Expert opinion: The AT is recommended for assessing the level of competency formation during ongoing progress control and intermediate assessment of students in the discipline " Theory of Electrical Networks ".

5. The validity period of the AT is determined by the period of implementation of the educational program.

1. Description of indicators and criteria for assessment at various stages of their formation, description of grading scales

Competency(ies), indicator(s)	Levels of competency formation			
	Minimum level not achieved (Unsatisfactory) – 2 points	Minimum level (Satisfactory) – 3 points	Medium level (Good) – 4 points	High level (Excellent) – 5 points
PC-2. Capable of participating in the design of objects of professional activity				
Learning outcomes for the discipline (module): Indicator: ИД-2. Evaluates the feasibility of implementing an investment project and selects the most optimal investment alternative.	Partially able to plan and conduct experimental studies related to determining the parameters and characteristics of electrical circuits, interpret data, and draw conclusions.	Has a general understanding of how to plan and conduct experimental, interpret data, and draw conclusions.	Knows how to plan and conduct experimental studies, fully able to interpret data, and draw conclusions	Fully able to plan and conduct experimental studies related to determining the parameters and characteristics of electrical circuits, interpret data, and draw conclusions.
PC-3. Capable of managing the power system operating mode of an electrical power supply system using digital technologies				
Learning outcomes for the discipline (module): Indicator: ИД-1. Performs calculations of the performance indicators of electrotechnical equipment and its systems;	Partially knows how to solve problems of calculation and analysis of electrical devices, objects and systems.	Has a general understanding of electrical engineering to solve problems of calculation and analysis of electrical devices, objects and systems.	Knows ways of solving electrical engineering problems of calculation and analysis of electrical devices, objects and systems.	Fully can apply knowledge of electrical engineering to solve problems of calculation and analysis of electrical devices, objects and systems.
Learning outcomes for the discipline (module): Indicator: ИД-2. Ensures the required operating modes and specified parameters of the technological process for elements of power supply systems;	Partially possesses the skills of methods for calculating steady- state processes in linear and nonlinear electrical circuits	Has a general understanding of methods for calculating steady- state processes in linear and nonlinear electrical circuits	Possesses the methods for calculating steady- state processes in linear and nonlinear electrical circuits	Fully can apply methods for calculating steady- state processes in linear and nonlinear electrical circuits

ASSESSMENT TOOLS FOR CHECKING THE LEVEL OF COMPETENCY FORMATION

Task No.	Correct Answer	Question Content	Competency
1.	1	How much charge is represented by 4,600 electrons? 1) $-7.369 \cdot 10^{-19} \text{ C}$ 2) $+7.369 \cdot 10^{-19} \text{ C}$ 3) $-14.369 \cdot 10^{-19} \text{ C}$ 4) $+3.369 \cdot 10^{-19} \text{ C}$	PC-2, PC-3
2.	1	To move charge q from point a to point b requires -30 J. Find the voltage drop if: 2 C 1) -15 V 2) +15 V 3) -5 V 4) +5 V	PC-2, PC-3
3.	1	How much energy does a 100-W electric bulb consume in two hours? 1) 200 Wh 2) 300 Wh 3) 50 Wh 4) 200 kWh	PC-2, PC-3

4.	1	A stove element draws 15 A when connected to a 240-V line. How long does it take to consume 60 kJ? 1) 16.667 s 2) 6.667 s 3) 30 s 4) 10 s	PC-2, PC-3
5.	1	If an electron beam in a TV picture tube carries 10^{13} electrons/second and is passing through plates maintained at a potential difference of 30 kV, calculate the power in the beam. 1) 48 mW 2) 48 W 3) 48 kW 4) 48 mWh	PC-2, PC-3
6.	1	One millivolt is one millionth of a volt. 1) False 2) True	PC-2, PC-3

7.	1	Which of these is not an electrical quantity? 1) time 2) charge 3) power 4) voltage 5) current	PC-2, PC-3
8.	1	An electric heater draws 10 A from a 120-V line. The resistance of the heater is: 1) 12 Ω 2) 1200 Ω 3) 1.2 Ω 4) 120 Ω	PC-2, PC-3
9.	1	A network has 12 branches and 8 independent loops. How many nodes are there in the network? 1) 5 2) 4 3) 17 4) 19	PC-2, PC-3

10.	1	The maximum current that a 2W, 80 k resistor can safely conduct is: 1) 5 mA 2) 160 kA 3) 40 kA 4) 25 μA	PC-2, PC-3
11.		The current through a branch in a linear network is 2 A when the input source voltage is 10 V. If the voltage is reduced to 1 V and the polarity is reversed. What is the current through the branch? the current through the branch is:	PC-2, PC-3
12.		For superposition, it is not required that only one independent source be considered at a time; any number of independent sources may be considered simultaneously.	PC-2, PC-3
13.		The superposition principle applies to power calculation.	PC-2, PC-3
14.		The Norton resistance is exactly equal to the Thevenin resistance.	PC-2, PC-3
15.		A load is connected to a network. At the terminals to which the load is connected, 10 Ω and $V=40$ V. The maximum possible power supplied to the load is:	PC-2, PC-3
16.		The source is supplying the maximum power to the load when the load resistance equals the source resistance.	PC-2, PC-3
17.		What charge is on a 5-F capacitor when it is connected across a 120-V source?	PC-2, PC-3
18.		When the total charge in a capacitor is doubled, the energy stored:	PC-2, PC-3
19.		The total capacitance of two 40-mF series-connected capacitors in parallel with a 4-mF capacitor is:	PC-2, PC-3

20.		Inductors in parallel can be combined just like resistors in parallel.	PC-2, PC-3
21.		A 5-H inductor changes its current by 3 A in 0.2 s. The voltage produced at the terminals of the inductor is:	PC-2, PC-3
22.		If the current through a 10-mH inductor increases from zero to 2 A, how much energy is stored in the inductor?	PC-2, PC-3
23.		An RC circuit has and The time constant is:	PC-2, PC-3
24.		The time constant for an RL circuit with $R=2\ \Omega$ and $L=4\ \text{H}$ is:	PC-2, PC-3
25.		A capacitor in an RC circuit with $R=2\ \Omega$ and $C=4\ \text{F}$ is being charged. The time required for the capacitor voltage to reach 63.2 percent of its steady-state value is:	PC-2, PC-3
26.		An RL circuit has $R=2\ \Omega$ and $L=4\ \text{H}$. The time needed for the inductor current to reach 40 percent of its steady-state value is:	PC-2, PC-3
27.		When a step input is applied to a second-order circuit, the final values of the circuit variables are found by:	PC-2, PC-3
28.		If the roots of the characteristic equation of an RLC circuit are -2 and -3, the response is:	PC-2, PC-3
29.		In a series RLC circuit, setting $R=0\ \Omega$ will produce:	PC-2, PC-3
30.		A parallel RLC circuit has $L=2\ \text{H}$ and $C=0.25\ \text{F}$. The value of R that will produce unity damping factor is:	PC-2, PC-3

2. Description of the grading scale

Within the framework of the rating system, student performance in each discipline is assessed during ongoing progress control and intermediate assessment. The rating system for assessing student knowledge is based on the use of a set of control measures (checkpoints) for testing the material covered, optimally located throughout the entire time interval of studying the discipline. The principles of the rating system for assessing student knowledge are based on the provisions described in the "Regulations on the organization of the educational process based on the rating system for assessing student knowledge" at North Caucasus Federal University.

The rating assessment system is not provided for students studying in master's degree programs, or for students studying in bachelor's degree programs by correspondence or part-time (evening) forms of study.

3. Criteria for assessing competencies

The grade "Excellent" is awarded to a student who has deeply and firmly mastered the program material, presents it exhaustively, consistently, clearly, and logically coherently, is able to closely link theory with practice, handles tasks, questions, and other types of knowledge application with ease, and does not struggle to answer when assignments are modified.

The grade "Good" is awarded to a student who has a solid command of the material, presents it competently and substantively without making significant inaccuracies in answering questions, correctly applies theoretical principles to practical questions and tasks, and possesses the necessary skills and techniques for their execution.

The grade "Satisfactory" is awarded to a student who has knowledge of only the basic material but has not mastered its details, makes inaccuracies, insufficiently correct formulations, and violates logical sequence in presenting the program material.

The grade "Unsatisfactory" is awarded to a student who does not know a significant part of the program material and makes substantial errors.