ACADEMIC DISCIPLINE SYLLABUS
«Transients in Power Supply Systems»

Educational Level	First (bachelor)
Educational-Professional program	"Electrical energetics, electrical engineering and electromechanics"
Duration of teaching	9, 10, 11, 12 quarters
Classes:	
lectures:	3 hours (9,10 quarters) 2 hours (11,12 quarters)
practical classes:	1 hour
Language of teaching	English

Course page in the system of distance education of DUT: https://do.nmu.org.ua/course/view.php?id=2111

Department of Electric Power Engineering

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1. Annotation to the course

Transients in power supply systems are an interdisciplinary field of knowledge in power engineering, which has two directions: "Electromagnetic transients" - investigate normal, emergency and abnormal processes in power systems and "Electromechanical transients" - explore static, dynamic and energy-resistant.

The purpose of the discipline - the formation of knowledge about electromagnetic and electromechanical transients in power systems, the impact of these processes on the modes of operation of electrical equipment; ability to form models that reflect electromagnetic transients in EPS, to calculate currents and voltages in symmetrical and asymmetric modes in normal and emergency states; about static and dynamic stability of the simplest system; ability to form models that reflect the electromechanical transients in EPS in order to assess the static and dynamic stability of the system; ability to analyze results and draw conclusions.

Disciplinary learning outcomes (DLO):

- Carry out the analysis of processes in the electric power, electrotechnical and electromechanical equipment, the corresponding complexes and systems.
- Select and apply suitable methods for analysis and synthesis of electromechanical and electrical systems with specified indicators.
- Analyze and calculate constant and transient processes for the prevention and elimination of accidents in electric power systems and facilities and ensuring static and dynamic stability.

2. Structure of the Course

LECTURES	PRACTICAL CLASSES
1 Basic principles of analysis of transients. General information about transients 2 Calculation of short circuit parameters 3 Parameter characteristics of synchronous machines	1 Ways to reduce the parameters of elements in the replacement schemes of power supply systems: accurate and approximate reduction; named and relative units of measurement. 2 Calculation of initial, shock and constant short-circuit currents:

4 Mains short circuit 5 Transients in three-phase short circuits. Calculation of short circuit currents 6 Calculations of transients in three-phase short circuits (generators). Calculations of transients at three-phase short circuits (load node) 7 Short circuit in electrical installations with voltage up to 1 kV 8 Transients in symmetry breaking in a three-phase network 9 Calculation of transverse asymmetry currents 10 Current and short-circuit power levels 11 Transients taking into account electromagnetic compatibility 12 Tasks of analysis and characteristics of electromechanical processes. 13 Static stability of the power system mode 14 Dynamic stability of the power system mode. 15 The resulting stability of the power system 16 Methods of analysis and calculation of static stability 17 Static stability of an adjustable electrical system 18 Stability of the load nodes regime at weak perturbations 19 Calculation of parameters of dynamic stability of the mode 20 Calculation of the parameters of the resulting stability of the mode 21 Stability of load nodes under strong perturbations	method of equivalent EMF, components of short-circuit current, vector diagram of short-circuit voltages and currents. 3 Calculation of the periodic component of short-circuit current at t> 0 using typical curves for generators, motors. 4 Considering local sources of replenishment of the short circuit. Condition of local sources: power supply from engines; power from reactive power sources; power supply from generalized load. 5 Calculation of asymmetric short-circuit currents. 6 Calculation of short circuits in electrical installations with voltage up to 1 kV 7 Calculation of current and short-circuit power limitation. 8 Calculation of the ideal actual power limit 9 Calculation of static stability of the power supply system in the power supply system 10 Calculation of dynamic stability of power supply modes in the power supply system 11 Calculations of measures to increase the stability of the regime in the power supply systems of enterprises.

3. Evaluation system and requirements

3.1. The academic achievements of higher education students based on the results of the course will be assessed on the scale below:

Rating scale	Institutional scale
90 – 100	Excellent
74 – 89	Good
60 – 73	Satisfactory
0 – 59	Fail

3.2 Applicants of higher education can receive **a final grade** in the academic discipline based on the current assessment of knowledge, provided that the number of points scored is at least 60 points.

Maximum rating:

Theoretical part	The practical part	Bonus	**Total**
60	40	5	**100**

During the study of the course, the applicant first completes an intermediate assessment based on the results of studies in one semester, and then takes an exam based on the results of studies in the next semester. The maximum assessment is carried out in each semester according to the above table.

The theoretical part in each semester is evaluated based on the results of passing two control test papers, each with 2 questions. These questions are open tests each weighing 15 points (60 points in total for the semester).

3.3 Evaluation criteria of theoretical work

Two open test questions are evaluated in **15 points each (30 points in total)**. The test survey is conducted using remote platform technology Moodle, Microsoft Office 365.

Wherein:

- **0 points** – there was no answer to the question or the answer was not relevant to the question;
- **3 points** – the answer is incomplete and contains only general data of the content of the question, or several serious mistakes were made in the answer;
- **6 points** – the answer is incomplete and contains a serious error or most of the answer is not related to the topic of the question;
- **9 points** – the answer basically reflects the essence of the question, but several inaccuracies were made or part of it does not correspond to the question, or the answer is schematic without the

necessary explanations;

- **12 points** – the answer fully corresponds to the question, but some explanations are missing or a slight inaccuracy is allowed, or there is no consistency in the answer;
- **15 points** – the answer fully corresponds to the question, contains the necessary explanations and drawings, is written concisely, consistently and competently, and also contains a situational analysis.

3.4 Evaluation criteria of practical work

The practical part in each semester consists of two practical modules containing one problem worth 20 points.

Problems from the practical part are listed in the system Moodle, Microsoft Office 365. Problems solved on paper are scanned (photographed) and sent to the teacher's e-mail within the time allotted for passing the relevant module of the practical part. An answer sent late is considered as not submitted.

A correctly solved **task** is valued at 20 points, wherein:

- **20 points** – correspondence to the solution of the problem, with units of measurement;
- **16 points** – correspondence to the solution of the problem, without measurement units or errors in calculations;
- **12 points** – minor errors in formulas, without units of measurement;
- **8 points** – there are significant errors in the decision;
- **4 points** – the given formulas do not fully correspond to the essence of the problem;
- **0 points –** the solution is not given.

3.5 Evaluation criteria of the final work

If the student of higher education received less than 60 points according to the current performance or seeks to improve the grade, **a final assessment (exam)** is conducted during the session.

The exam is conducted in the form of a complex control paper, which includes questions from the theoretical and practical part of the course. The ticket consists of three theoretical open tests and two practical open tests (tasks) each weighing 20 points **(100 points in total)**.

Wherein:

- **20 points** – full correspondence to the essence of the question;
- **15 points** – compliance with the essence of the question with minor deviations and inaccuracies;
- **10 points** – partial correspondence to the essence of the question without its full disclosure;
- **5 points** – there are significant errors in the performance of the test;
- **0 points** – the answer is not given or does not relate to the topic of the question.
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4. Course policy

4.1. Academic Integrity Policy

Academic integrity of higher education students is an important condition for mastering the results of training in the discipline and obtaining a satisfactory grade from the current and final tests. Academic integrity is based on condemnation of the practices of copying (writing with external sources other than those permitted for use), plagiarism (reproduction of published texts by other authors without attribution), fabrication (fabrication of data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation "Regulations on the system of prevention and detection of plagiarism at the Dnipro University of Technology". http://www.nmu.org.ua/ua/content/activity/us_documents/System_of_prevention_and_detection_of_plagiarism.pdf.

In case of violation of academic integrity by a higher education applicant (copying, plagiarism, fabrication), the work is evaluated unsatisfactorily and must be repeated. The teacher reserves the right to change the topic of the task.

4.2. Communication policy

Applicants for higher education must have activated university mail.

All written questions to teachers regarding the course should be sent to the university e-mail.

4.3. Retaking policy

Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Relocation takes place with the permission of the dean's office if there are good reasons (for example, sick leave).

4.4 Evaluation Appeal Policy

If the applicant does not agree with the assessment of his knowledge, he may protest the assessment given by the teacher in the prescribed manner.

4.5. Attending classes

For higher education students, full-time attendance is mandatory. For applicants for higher education who receive educational services under the Dual form of education, an individual schedule is provided. Good reasons for not attending classes are illness, participation in university events, academic mobility, which must be documented. The applicant for higher education must inform the teacher either in person or through the headmaster about the absence from classes and the reasons for absence.

For objective reasons (for example, academic mobility) training can take place online in consultation with the course leader.

5. Recommended sources of information

1. Перехідні процеси в системах електропостачання: підручник / Г.Г. Півняк, І.В. Жежеленко, Ю.А. Папаїка, Л.І. Несен; за ред. Г.Г. Півняка; М-во освіти і науки України, Нац. Гірн. Ун-т. – 5-те вид., доопрац. і допов. –Дніпро: НГУ, 2016. – 600 с. / Transition processes in power supply systems: a textbook / G.G. Pivnyak, I.V. Zhezhelenko, Y.A. Papaika, L. I. Necen; under the editorship of G.G. Pivnyak; Ministry of Education and Science of Ukraine, NMU – 5th ed., revised. and add. - Dnipro: NMU, 2016. - 600 p.
2. Перехідні процеси в системах електропостачання. Підручник. Вид. 2-е, 3-є, доопрац. та допов. / Г.Г.Півняк, В.М.Віславський, А.Я.Рибалко, Л.І.Несен / за ред. академіка НАН України Г.Г.Півняка. – Дніпропетровськ: НГАУ, 2000, 2003. – 597 с. / Transients in power supply systems: Textbook / G.G. Pivnyak, V. N. Vynoslavskyi, A. Ya. Rybalko, L. I. Necen; under the editorship of G.G. Pivnyak. – Dnipropetrovsk: NMU, 2000, 2003 - 597 p.
3. Transients in Electric Power Supply Systems. Textbook for institutions of higher education: under the editorship of G.G.Pivnyak / G.G.Pivnyak, I.V.Zhezhelenko, Y.A.Papaika; Ministry of Education and Science of Ukranian, National Mining University – 5-th edition, revised and expanded: Translation from Ukranian. – Trans Tech Publications Ltd, Switzerland, 2016. – 382 p.
4. Transients in Electric Power Supply Systems. Volume 1: the textbook for institutions of higher education / G. Pivnyak, V. Vinoslavskiy, A. Rybalko, L. Nesen; under the general editorship of G. Pivnyak, Academician of National Academy of Sciences of Ukraine. Editorship of the English version and terminology by Professors O. Ivanov and S. Kostritskaya – 4th edition: Translation from Ukrainian. – Dnipropetrovsk: National Mining University. – 2005. – 248 pp.
5. Transients in Electric Power Supply Systems. Textbook for institutions of higher education / G. Pivnyak, V. Vinoslavskiy, A. Rybalko, L. Nesen, V. Procopenko; under the general editorship of G. Pivnyak, Academician of National Academy of Sciences of Ukraine. Editorship of the English version and terminology by Professors O. Ivanov and S. Kostritskaya – 5th edition: Translation from Ukrainian. – Dnipropetrovsk: National Mining University. – 2009. – 406 pp.