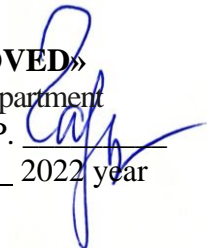


Ministry of Education and Science of Ukraine
Dnipro University of Technology

Department of Physics



«APPROVED»
Head of Department
Harkusha Ihor P. 
«29» August 2022 year

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

«General Physics»

Field of study	14 Electrical engineering
Specialty	141 Electrical energetics, electrical engineering and electromechanics
Academic level	first (bachelor)
Academic program	«Electrical energetics, electrical engineering and electromechanics»
Specialization.....	-
Status	normative
Total workload	11 credits ECTS (330 hours)
Type of summative assessment.	exam
Period of study	1, 2 semesters (1-4 terms)
Language of study	English

Lecturer: Assoc.Prof. Voronko T.Y.

Prolonged: for 20__/20__ academic year _____ (_____) «__» 20__.
(Signature, name, date)
for 20__/20__ academic year _____ (_____) «__» 20__.
(Signature, name, date)

Dnipro
DNIPROTECH
2022

Work program of the academic discipline «General Physics» for bachelors of the educational and professional program «Electrical energetics, electrical engineering and electromechanics» of the specialty 141 Electrical energetics, electrical engineering and electromechanics / Dnipro University of Technology, Department of Physics. – D.: DNIPROTECH», 2022. – 13 p.

Author:

– Voronko Tetiana Yevhenivna – Candidate of Physical-Mathematical Sciences, Associate Professor of the Department of Physics.

The work program regulates:

- the aim of the discipline;
- the disciplinary learning outcomes generated through the transformation of the intended learning outcomes of the degree program;
- basic disciplines;
- volume and distribution by forms of organization of the educational process and types of classes;
- discipline program (thematic plan by type of training);
- algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and assessment criteria);
- tools, equipment and software;
- recommended sources of information.

The work program is designed to implement a competency approach in planning an education process, delivery of the academic discipline, preparing students for control activities, controlling the implementation of educational activities, internal and external quality assurance in higher education, accreditation of degree programs within the specialty.

Approved by the decision of the Scientific and Methodological Commission of the specialty 141 Electrical energetics, electrical engineering and electromechanics (protocol №21/22-07 of 14.07.2022).

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1 AIM OF THE DISCIPLINE

In the educational and professional program «Electrical energetics, electrical engineering and electromechanics» of the specialty 141 Electrical energetics, electrical engineering and electromechanics the distribution of program learning outcomes (PLO) for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the discipline B2 «General physics»:

PLO07	To carry out analysis of processes in electrical, electrical and electromechanical equipment, relevant complexes and systems.
PLO08	To Select and apply suitable methods for analysis and synthesis of electromechanical and electrical systems with specified parameters.

The aim of the discipline – formation acquirers of competencies, skills and knowledge in the field of physics regarding fundamental concepts, laws and theories of classical and modern physics, which provides them with effective mastery of special disciplines and the further possibility of using physical principles in the field of electrical engineering.

The implementation of the aim requires transforming program learning outcomes into the disciplinary ones as well as an adequate selection of the contents of the discipline according to this criterion.

2 INTENDED DISCIPLINARY LEARNING OUTCOMES

Code PLO	Disciplinary learning outcomes (DLO)	
	DLO code	content
PLO07	PLO07.1-B2	analyze the results of observations and experiments using the basic laws of physics, use physical devices
	PLO07.2-B2	to analyze physical mechanisms that are essential when considering processes in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems
	PLO07.3-B2	formation of abilities to generalize, analyze, perceive information, set a scientific problem and choose a way to solve it
PLO08	PLO08.1-B2	formulate physical ideas, solve problems, estimate quantities, operate physical models and be aware of the limits of their applications
	PLO08.2-B2	apply knowledge of the basic fundamental laws of classical and modern physics to solve electrical engineering problems
	PLO08.3-B2	correctly reproduce physical ideas and correctly apply the principles and laws of physics for the analysis and synthesis of electromechanical and electric power systems with specified indicators

3 BASIC DISCIPLINES

The discipline is taught in the first and second semesters in accordance with the curriculum, so no additional requirements for basic disciplines are established. Interdisciplinary connections: the study of the course is based on knowledge obtained from the disciplines studied at the previous level of education s.

4 WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES

Type of classes	Workload <i>hours</i>	Distribution by forms of education, <i>hours</i>					
		Full-time		Part-time		Extramural	
		Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)
lecture	210	74	136	-	-	16	194
practical	-	-	-	-	-	-	-
laboratory	120	46	74	-	-	14	134
seminars	-	-	-	-	-	-	-
TOTAL	330	120	210	-	-	30	300

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

DLO code	Types and topics of training sessions	Volume of components, <i>hours</i>
	LECTURES	210
PLO07.1-B2	1 Physical foundations of mechanics	40
PLO07.2-B2	1.1. Introduction to mechanics.	
PLO07.3-B2	1.2. Elements of kinematics.	
PLO08.1-B2	1.3. Dynamics of a material point and translational motion of a rigid body. Forces in mechanics.	
PLO08.2-B2	1.4. Dynamics of a rigid body that has a fixed axis of rotation.	
PLO08.3-B2	1.5. Conservation laws.	
	1.6. Elements of special relativity	
PLO07.1-B2	2 Electrodynamics	64
PLO07.2-B2	2.1. General information about the electrostatic field. Electrostatic field in vacuum.	
PLO07.3-B2	2.2. Electrostatic field in matter.	
PLO08.1-B2	2.3. Direct electric current.	
PLO08.2-B2	2.4. Electric current in gases.	
PLO08.3-B2	2.5. A constant magnetic field in a vacuum.	
	2.6. The effect of a magnetic field on moving charges and a current-carrying conductor.	
	2.7. Magnetic field in matter.	
	2.8. The phenomenon of electromagnetic induction.	
	2.9. Fundamentals of Maxwell's theory for the electromagnetic field	
PLO07.1-B2	3. Oscillatory and wave processes	44
PLO07.2-B2	3.1. General information about oscillating processes, free oscillations.	
PLO07.3-B2	3.2. Addition of harmonic oscillations, forced oscillations.	
PLO08.1-B2	3.3. Wave processes, elastic waves.	
PLO08.2-B2	3.4. Electromagnetic waves.	
PLO08.3-B2	3.5. The concept of alternating current. Periodic processes in alternating current circuits.	
	3.6. General information about light waves. Interference of light.	

DLO code	Types and topics of training sessions	Volume of components, hours
	Diffraction of light. Polarization and dispersion of light.	
	3.7. Elements of quantum mechanics.	
PLO07.1-B2 PLO07.2-B2 PLO07.3-B2 PLO08.1-B2 PLO08.2-B2 PLO08.3-B2	4. Molecular physics and thermodynamics 4.1. Elements of classical and quantum statistics. 4.2. Fundamentals of thermodynamics. 4.3. Elements of physical kinetics. Transfer processes. 4.4. Aggregate states. Phase equilibrium and phase transformations.	30
PLO07.1-B2 PLO07.2-B2 PLO07.3-B2 PLO08.1-B2 PLO08.2-B2 PLO08.3-B2	5. Elements of quantum theory of radiation, atomic physics and solid state physics 5.1. Fundamentals of quantum theory of thermal radiation. 5.2. Some quantum optical effects. 5.3. Physical foundations of quantum electronics. Spontaneous and forced radiation. 5.4. Elements of atomic physics. 5.5. Elements of band theory of solids and semiconductor physics.	14
PLO07.1-B2 PLO07.2-B2 PLO07.3-B2 PLO08.1-B2 PLO08.2-B2 PLO08.3-B2	6. Physics of the atomic nucleus 6.1. Composition, binding energy of the nucleus and static characteristics of atomic nuclei. 6.2. Nuclear reactions. Radioactivity. 6.3. Elements of dosimetry and physical bases of nuclear energy. 6.4. Fundamental particles and interactions; modern physical picture of the world.	14
	PRACTICAL TRAINING	120
PLO07.1-B2	1. Laboratory work on the physical foundations of mechanics	20
PLO07.2-B2	2. Laboratory work on electrodynamics	42
PLO07.3-B2	3. Laboratory work on oscillatory and wave processes	30
PLO08.1-B2	4. Laboratory works on molecular physics and thermodynamics	16
PLO08.2-B2 PLO08.3-B2	5. Laboratory work on elements of quantum theory of radiation, atomic physics and solid state physics	8
	6. Laboratory work on atomic nucleus physics	4
	TOTAL	330

6 KNOWLEDGE PROGRESS TESTING

Certification of student achievement is accomplished through transparent procedures based on objective criteria in accordance with the University Regulations “On Evaluation of Higher Education Applicants' Learning Outcomes”.

The level of competencies achieved in relation to the expectations, identified during the control activities, reflects the real result of the student's study of the discipline.

6.1 Grading scales

Assessment of academic achievement of students of the Dnipro University of Technology is carried out based on a rating (100-point) and institutional grading scales. The latter is necessary (in the official absence of a national scale) to convert (transfer) grades for mobile students.

The scales of assessment of learning outcomes of the DNIPROTECH students

Rating	Institutional
90...100	відмінно / Excellent
74...89	добре / Good
60...73	задовільно / Satisfactory
0...59	незадовільно / Fail

Discipline credits are scored if the student has a final grade of at least 60 points. A lower grade is considered to be an academic debt that is subject to liquidation in accordance with the Regulations on the Organization of the Educational Process of DNIPROTECH.

6.2 Tools and procedures

The content of diagnostic tools is aimed at controlling the level of knowledge, proficiency/skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 6th qualification level during the demonstration of the learning outcomes regulated by the work program.

During the control activities, the student should perform tasks focused solely on the demonstration of disciplinary learning outcomes (Section 2).

Diagnostic tools provided to students at the control activities in the form of tasks for the formative and summative knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the formative and summative knowledge progress testing are approved by the department.

Type of diagnostic tools and procedures for evaluating the formative and summative knowledge progress testing are given below.

Diagnostic and assessment procedures

FORMATIVE ASSESSMENT			SUMMATIVE ASSESSMENT	
training sessions	diagnostic tools	procedures	diagnostic tools	procedures
lectures	control tasks for each topic	task during lectures	comprehensive reference work (CCW)	determining the average results of intermediate controls;
laboratory lessons	verification and protection	performance of laboratory work		CCW performance during the examination at the request of the student

During the intermediate control, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Laboratory classes are evaluated by the quality of performance and defense of laboratory work.

If the content of a certain type of classes is subordinated to several components of the description of the qualification level according to the NQF, the integral value of the grade can be determined taking into account the weighting coefficients set by the lecturer.

Provided that the level of results of the formative assessments of all types of training at least 60 points, the summative assessment can be carried out without the student's immediate participation by determining the weighted average value of the obtained grades.

Regardless of the results of the formative assessments, every student during the summative knowledge progress testing has the right to perform the CCW, which contains tasks covering key disciplinary learning outcomes.

The number of specific tasks of the CCW should be consistent with the allotted time for completion. The number of CCW options should ensure that the task is individualized.

The value of the mark for the implementation of the CCW is determined by the average evaluation of the components (specific tasks) and is final.

The integral value of the assessment of the implementation of the CCW can be determined taking into account the weighting coefficients established by the department for each component of the description of the qualification level of the NQF.

6.3 Criteria

Actual student learning outcomes are identified and measured relative to what is expected during the control activities using criteria that describe the student's actions to demonstrate the achievement of learning outcomes.

To assess the performance of control tasks during the formative assessment on lectures and laboratory classes the coefficient of mastery is used as a criterion, which automatically adapts the assessment indicator to the rating scale:

$$O_i = 100 a/m,$$

where a – number of correct answers or significant operations performed according to the solution standard; m – the total number of questions or substantial operations of the standard.

Individual tasks and complex control works are expertly evaluated using criteria that characterize the ratio of competency requirements and evaluation indicators to a rating scale.

The content of the criteria is based on the competency characteristics defined by the NQF for the bachelor's level of higher education (given below).

General criteria for achieving learning outcomes for the 6th qualification level of NQF (bachelor)

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
<i>Knowleges</i>		
Conceptual scientific and practical knowledge, critical understanding of theories, principles, methods and concepts in the field of professional activity and / or training	The answer is excellent - correct, reasonable, meaningful. Characterizes the presence of: - conceptual knowledge; - high degree of knowledge of the state of the art; - critical understanding of the basic theories, principles, methods and concepts in education and professional activity	95-100
	The answer contains minor errors or omissions	90-94
	The answer is correct, but has some inaccuracies	85-89
	The answer is correct, but has some inaccuracies and is insufficiently substantiated	80-84
	The answer is correct, but has some inaccuracies, insufficiently substantiated and meaningful	74-79
	The answer is fragmentary	70-73
	The answer shows the student's vague ideas about the object of study	65-69
	The level of knowledge is minimally satisfactory	60-64
	The level of knowledge is unsatisfactory	<60
<i>Proficiency/Skills</i>		
In-depth cognitive and practical skills, mastery and innovation at the level required to solve complex specialized tasks and	The answer characterizes the ability to: - identify problems; - formulate hypotheses; - solve problems; - choose appropriate methods and tools; - collect and interpret information logically and	95-100

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
practical problems in the field of professional activity or training	clearly; - use innovative approaches to solving problems	
	The answer characterizes the ability to apply knowledge in practice with minor errors	90-94
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of one requirement	85-89
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the two requirements	80-84
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the three requirements	74-79
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the four requirements	70-73
	The answer characterizes the ability to apply knowledge in practice when performing tasks on the model	65-69
	The answer characterizes the ability to apply knowledge in performing tasks on the model, but with inaccuracies	60-64
	The level of skills is unsatisfactory	<60
Communication		
<ul style="list-style-type: none"> ♦ reporting to specialists and non-specialists information, ideas, problems, solutions, own experience and argumentation ♦ data collection, interpretation and application ♦ communication on professional issues, including in a foreign language, orally and in writing 	Fluency in industry issues. Clarity of the answer (report). Language: <ul style="list-style-type: none"> - correct; - clean; - clear; - accurate; - logical; - expressive; - concise. Communication strategy: <ul style="list-style-type: none"> - consistent and consistent development of thought; - the presence of logical own judgments; - appropriate reasoning and its compliance with the defended provisions; - correct structure of the answer (report); - correct answers to questions; - appropriate technique for answering questions; - ability to draw conclusions and formulate proposals; 	95-100
	Sufficient knowledge of industry issues with minor flaws. Sufficient clarity of the answer (report) with minor flaws. Relevant communication strategy with minor flaws.	90-94
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (three requirements in total are not realized)	85-89
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (four requirements not	80-84

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	implemented in total)	
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (five requirements not implemented in total)	74-79
	Satisfactory knowledge of industry issues. Satisfactory clarity of the answer (report) and appropriate communication strategy (a total of seven requirements have not been implemented)	70-73
	Partial knowledge of industry issues. Satisfactory clarity of the answer (report) and communication strategy with errors (a total of nine requirements are not implemented)	65-69
	Partial knowledge of industry issues. Satisfactory clarity of the answer (report) and communication strategy with errors (a total of 10 requirements are not implemented)	60-64
	The level of communication is unsatisfactory	<60
<i>Autonomy and responsibility</i>		
<ul style="list-style-type: none"> ♦ managing complex technical or professional activities or projects ♦ ability to take responsibility for making and making decisions in unpredictable work and / or learning contexts ♦ formation of judgments that take into account social, scientific and ethical aspects ♦ organization and management of professional development of individuals and groups ♦ ability to continue studies with a significant degree of autonomy 	Excellent command of personal management competencies focused on: 1) management of complex projects, which involves: - research nature of educational activities, marked by the ability to independently assess various life situations, phenomena, facts, identify and defend a personal position; - ability to work in a team; - control of own actions; 2) responsibility for decision-making in unpredictable conditions, including: - justification of own decisions by the provisions of the regulatory framework of the industry and state levels; - independence in the performance of tasks; - initiative in discussing problems; - responsibility for relationships; 3) responsibility for the professional development of individuals and/or groups of individuals, which involves - use of professionally oriented skills; - use of evidence with independent and correct argumentation; - mastery of all types of learning activities; 4) the ability to continue learning with a high level of autonomy, which includes - the degree of mastery of fundamental knowledge; - independence of evaluative judgments; - a high level of general learning skills; - - independent search and analysis of information sources	95-100
	Good mastery of personality management competencies (two requirements not met)	90-94
	Good mastery of personality management competencies (three requirements not met)	85-89

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	Good mastery of personality management competencies (four requirements not met)	80-84
	Good mastery of personality management competencies (six requirements not met)	74-79
	Satisfactory mastery of personality management competencies (seven requirements not met)	70-73
	Satisfactory mastery of personality management competencies (eight requirements not met)	65-69
	The level of responsibility and autonomy is fragmentary	60-64
	The level of autonomy and responsibility is unsatisfactory	<60

7 TOOLS, EQUIPMENT AND SOFTWARE

Specialized equipment is used for conducting demonstration experiments during lectures, physical laboratory workshops on specialized stands, computer laboratory work, multimedia equipment, and the remote platform Moodle.

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WORK PROGRAM OF THE ACADEMIC DISCIPLINE

«Physics» for bachelors of the educational and professional program «Electrical energetics, electrical engineering and electromechanics» of the specialty 141
Electrical energetics, electrical engineering and electromechanics

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