

Ministry of Education and Science of Ukraine
Dnipro University of Technology

Department of Engineering, Technical Aesthetics and Design



«APPROVED»

Dean of Faculty

Ziborov K. _____

«30» August 2022

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

«Engineering and computer graphics»

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	4 credits ECTS (120 hours)
Type of summative assessment...	differentiated test
Period of study	1, 2 semesters (2-4 terms)
Language of study.....	English

Lecturer: Assoc.Prof. Fedoriachenko S.O.

Prolonged: for 20__/20__ a.y. _____ (_____) «__» 20__ year.
(signature, last name, first name, date)

for 20__/20__ a.y. _____ (_____) «__» 20__ year.
(signature, last name, first name, date)

Dnipro
DNIPROTECH
2022

Work program of the academic discipline «Engineering and computer graphics» 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 Engineering, Technical Aesthetics and Design. – D.: DNIPROTECH, 2022 – 13 p.

Author:

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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 Б4 «Engineering and Computer Graphics»:

PLO17	To solve complex specialized problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks
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The aim of the discipline is to form competencies in the means of depicting spatial forms on a plane with the use of computer technology, which is the foundation on which the basic rules of technical drawing are based.

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)	
	Code DLO	content
PLO17	PLO17.1-Б4	Use the concepts and laws of descriptive geometry to formulate and solve scientific and scientific-technical problems with the reflection of geometric objects on the plane. To acquire knowledge of the development of design documentation based on the ability to make sketches and drawings of parts, read and detail assembly drawings, mark materials and develop drawings of electrical circuits using computer-aided design tools.

3. BASIC DISCIPLINES

The discipline is taught starting from the 1st semester in accordance with the curriculum, so there are no additional requirements for basic disciplines. Interdisciplinary connections: the course is based on the knowledge gained from the disciplines studied at the previous level of education.

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

Type of classes	Workload hours	Distribution by forms of education, hours					
		Full-time		Part-time		Extramural	
		Classes (C)	Individual work	Class work	Classes (C)	Class work	Individual work
lectures	60	29	31	-	-	6	54
practical	-	-	-	-	-	-	-
laboratory	60	17	43	-	-	6	54
seminars	-	-	-	-	-	-	-
TOTAL	120	46	74	-	-	12	108

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

Code DLO	Types and topics of training sessions	Volume of components, hours
	LECTURES	60
1 semester		
PLO17.1-B4	Preface. The method of projections. Types of projections. Projections of a point. The method of G. Monge.	4
	The straight line. Position of the line relative to the projection planes. Natural size and angles of inclination to the projection planes of the line of general position. Relative position of a point and a line, two lines.	4
	The plane. Ways to set the plane on a complex drawing. Classification of planes. A line and a point in a plane.	6
	Curved lines and surfaces. Classification. Formation of shapes.	6
	Fundamentals of drawing. Basic rules of drawing.	6
	Total lectures for 1 semester	26
	2 semester	
	Fundamentals of computer-aided design: an overview of the main CAD systems for developing design documentation and 3D modeling of technical objects. Basic functionality of 2D and 3D modeling of computer-aided design systems (for example, AutoCAD, Inventor).	4
	Projection of geometric bodies. Projections of a point and a straight line belonging to the surface of an object. Building a third projection from two given ones.	4
	Images: views, sections, cross-sections.	6
	Working mechanical engineering drawings. Text inscriptions on the drawings. Designation of materials on detail drawings.	4
	Threads. Conventional image and designation of threads. Elements of threads. Standard threaded fasteners and their designations. Threaded connections.	4
	Basic rules for making sketches and working drawings.	4
	Reading and detailing assembly drawings. Features of assembly drawing design. Specifications.	4
	Drawings of electrical circuits. Reading. Rules of formatting. Graphic designations of elements.	4
	Total lectures for 2 semester	34
	LABORATORY CLASSES	60
	USDD standards. Elements of the drawing. Formats, scales, lines, drawing fonts, graphic designations of materials. Application of dimensions. Geometric constructions of slope and conicity. Work on task 1 - "Building images and drawing sizes of simple parts"	8
	Fundamentals of computer-aided design. Basic functionality of 2D and 3D modeling of computer-aided design systems (for example, AutoCAD, Inventor). Developing skills in creating 2D and 3D images of simple shapes. Creating associative images.	10
	Work on task 2 - "Construction of the line of intersection of surfaces of rotation by means of 2D and 3D modeling of computer-aided design systems"	8
	Work on task 3 - "Building a drawing and the necessary sections of the model according to its visual representation"	8
	Work on task 4 - "Construction of the drawing and the necessary sections of the model by its views"	8

Code DLO	Types and topics of training sessions	Volume of components, hours
	Work on task 5 - "Performing sketches and working drawings of parts based on the assembly drawing of the unit"	8
	Work on the task - 6 "Performing a drawing of the electrical circuit of the device"	10
	Total laboratory classes for 2 semester	60
	TOTAL	120

For the implementation of the mixed form of education of students, the electronic resources of the e-learning platform in the discipline are used:

<https://do.nmu.org.ua/course/view.php?id=974>

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.

Types 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	performing the tasks during individual work	complex control work (CCW)	determination of the average result of formative assessments
laboratory	laboratory tasks for each topic	performing the tasks during laboratory classes		performing of CCW during the differentiated test at the request of the student
	an individual task	performing the tasks during individual work		

During the formative assessment, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Laboratory classes are assessed by the quality of the control (individual) task.

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 is a number of correct answers or significant operations performed in accordance with the decision standard; m is the total number of questions or significant operations of the standard.

Individual tasks and complex control works are assessed expertly using criteria that characterize the ratio of requirements to the level of competencies and indicators of assessment on 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>		

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
In-depth cognitive and practical skills, mastery and innovation at the level required to solve complex specialized tasks and practical problems in the field of professional activity or training	The answer characterizes the ability to: - identify problems; - formulate hypotheses; - solve problems; - choose appropriate methods and tools; - collect and interpret information logically and clearly; - use innovative approaches to solving problems	95-100
	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: - correct; - clean; - clear; - accurate; - logical; - expressive; - concise. Communication strategy: - 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.	85-89

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	Good clarity of the answer (report) and appropriate communication strategy (three requirements in total are not realized)	
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (four requirements not implemented in total)	80-84
	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 	<p>Excellent command of personal management competencies focused on:</p> <p>1) management of complex projects, which involves:</p> <ul style="list-style-type: none"> - 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; <p>2) responsibility for decision-making in unpredictable conditions, including:</p> <ul style="list-style-type: none"> - 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; <p>3) responsibility for the professional development of individuals and/or groups of individuals, which involves</p> <ul style="list-style-type: none"> - use of professionally oriented skills; - use of evidence with independent and correct argumentation; - mastery of all types of learning activities; <p>4) the ability to continue learning with a high level of autonomy, which includes</p> <ul style="list-style-type: none"> - the degree of mastery of fundamental knowledge; - independence of evaluative judgments; 	95-100

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	- a high level of general learning skills; - independent search and analysis of information sources	
	Good mastery of personality management competencies (two requirements not met)	90-94
	Good mastery of personality management competencies (three requirements not met)	85-89
	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

Technical training tools.

Remote platform Moodle, Microsoft Office 365 (corporate mail, MS Teams).

8. RECOMMENDED SOURCES OF INFORMATION

1. Методичні рекомендації з геометричного та проєкційного креслення з дисципліни «Інженерна та комп'ютерна графіка» /О.С. Жовтяк, Т.С. Савельєва, Д. С. Пустовой, – Дніпро: ДВНЗ «НГУ», 2017. – 64 с.

2. Ванжа Г.К. Геометричне креслення [Текст]: навчально-наочний посібник / Г.К. Ванжа, О.С. Жовтяк, О.О. Якушева, А.С. Тен – Д.: Національний гірничий університет, 2013. – 242 с.

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Supplementary:

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Editorial by the author

Prepared for publication
Dnipro University of Technology.
Certificate of registration in the State Register ДК № 1842
49005, Dnipro, Dmytra Yavornytskoho Ave. 19