**Ministry of Education and Science of Ukraine**
**Dnipro University of Technology**

**Department of Information Technology and Computer Engineering**

**"APPROVED"**
Head of Department
Hnatushenko V.V. _____
«31» august 2021

# WORK PROGRAM OF THE ACADEMIC DISCIPLINE
## "Computer science"

| | |
|---|---|
| Field of study..... | 14 Electrical engineering |
| Specialty..... | 141 Electric Power Engineering, Electrical Engineering and Electromechanics |
| Academic degree..... | First (bachelor) |
| Academic program..... | Electric Power Engineering, Electrical Engineering and Electromechanics |
| Type of discipline..... | compulsory |
| Total workload..... | 5 credits ECTS (150 hours) |
| Type of final assessment..... | graded test (1 semester)<br>exam (2 semester) |
| Period of study..... | 1 semester, 1st and 2nd quarters<br>2 semester, 3 quarter |
| Language of study..... | English |

Lecturers: Associate Professor Kashtan V.Yu.

Prolonged: for 2021 / 2022 academic year _____ (V.Yu.Kashtan) "31" 08 2021.
(Signature, name) (date)

for 20 __ / 20 __ academic year _____ (_____) "__" ___ 20__.
(Signature, name) (date)

Dnipro
Dnipro University of Technology
2021

Work program of the academic discipline **"Computer science"** for bachelor's specialty 141 Electric Power Engineering, Electrical Engineering and Electromechanics. Dnipro University of Technology Department of Information Technology and Computer Engineering. - D: Dnipro University of Technology 2021. - 16 p.

Authors – Kashtan V.Yu., Associate Professor at the department of Information Technology and Computer Engineering

The work program regulates:

– key goals and objectives;
– the disciplinary learning outcomes generated through the transformation of the intended learning outcomes of the degree program;
– the content of the discipline formed according to the criterion "disciplinary learning outcomes";
– the discipline program (thematic plan by different types of classes);
– distribution of the discipline workload by different types of classes;
– an algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and evaluation criteria);
– criteria and procedures for evaluating the academic achievements of applicants by discipline;
– the contents of the educational and methodological support of the discipline;

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-Methodical Commission of specialty 141 «Electric Power Engineering, Electrical Engineering and Electromechanics» at the request of the Department of Higher Mathematics (protocol № 21\22-01 dated 30.08.2021).

# CONTENTS

## 1 DISCIPLINE OBJECTIVES

In the educational and professional programs of the Dnipro University of Technology specialty 141 Electric Power Engineering, Electrical Engineering and Electromechanics, the distribution of program learning outcomes (NRN) for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the discipline Б3 "**Computer science**":

| | |
|---|---|
| ПР06 | Appling the application software, microcontrollers and microprocessor technology to solve practical problems in professional activities. |
| ПР18 | To be able to learn independently, to master new knowledge and to improve skills of work with the modern equipment, measuring equipment and the applied software. |

**The objective of discipline** – formation of competencies to the fundamentals of computer hardware and software and covered are mobile devices, virtualization and cloud computing, as well as expanded information about Microsoft Windows operating systems, security, networking, troubleshooting, and the responsibilities of an IT professional.

The implementation of the objective 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 NRN** | **Disciplinary learning outcomes (DRN)** | |
|---|---|---|
| | **DRN code** | **content** |
| ПР06 | ПР06.1-Б3 | Knowing the basics and principles of computer architecture, history of its development, number systems, units of measurement and presentation of data in computer memory. |
| | ПР06.2-Б3 | Developing the simpler console programs based on the acquired knowledge on building algorithms and programming skills in C ++ language. |
| ПР18 | ПР18.1-Б3 | Demonstrate knowledge and skills of work with interfaces of computer systems, data coding in computers and modern information technologies |
| | ПР18.2-Б3 | Ability to install and configure components to build, repair, or upgrade personal computers |
| | ПР18.3-Б3 | Classify and use in practice system and application software |
| | ПР18.4-Б3 | Ability to configure devices for data transmission over the network |
| | ПР18.5-Б3 | Implementation of calculations in the development of console programs and programs with a graphical user interface in the operating environment MS Windows |

## 3 BASIC DISCIPLINES

Since the discipline is studied in the first semester of the first year of study, there are no basic disciplines.

## 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** | | **Distance** | |
| | | Classes (C) | Individual work (IW) | Classes (C) | Individual work (IW) | Classes (C) | Individual work (IW) |
| 1 semester | | | | | | | |
| lecture | 38 | 26 | 12 | - | - | - | - |
| practical | 16 | 13 | 3 | - | - | - | - |
| laboratory | 35 | 26 | 9 | - | - | - | - |
| TOGETHER in the 1st semester | 89 | 65 | 24 | - | - | - | - |
| 2 semester | | | | | | | |
| lecture | 33 | 18 | 15 | - | - | - | - |
| laboratory | 28 | 9 | 19 | - | - | - | - |
| TOGETHER in the 2d semester | 61 | 27 | 34 | - | - | - | - |
| **TOGETHER (1st and 2d semesters)** | **150** | **92** | **58** | - | - | - | - |

## 5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

| **Ciphers ДРН** | **Types and topics of training sessions** | **Hours** |
|---|---|---|
| | ***1 semester*** | |
| | **LECTURES** | **38** |
| ПР18.1-Б3 | **1. Introduction to computer engineering and programming** | 4 |
| | Information, its types and properties. | |
| | The concept of personal computers, their role in computer science. | |
| | Significance and main directions of application of computer technology in the field of electrical engineering. | |
| ПР18.2-Б3 | **2. Personal Computer Hardware** | 5 |
| | Case and power supplies | |
| | Motherboard Components | |
| | CPUs and Cooling Systems | |
| | Types of Memory | |
| | Adapter Cards and Expansion Slots | |
| | Hard disk drives and SSDs | |

| Ciphers ДРН | Types and topics of training sessions | Hours |
|---|---|---|
| | Optical Storage Devices | |
| | Personal computer input, output devices. | |
| | Characteristics of the main parts of the laptop | |
| | Electrical Power | |
| | Arithmetic basics of a personal computer | |
| | Logical basics of a personal computer | |
| | Configurations for Specialized Computers | |
| | **3. Computer Assembly and Disassembly** | |
| | General and Fire Safety | |
| | Install the Motherboard Components | |
| | Install the RAM | |
| | Ports, Connectors, and Cables | 6 |
| | Identify the tools and software used with personal computer components and their purpose. | |
| | Steps of installation work | |
| | Boot the computer after it is assembled | |
| | Computer configuration of the system components | |
| | **4. Preventive Maintenance and Troubleshooting** | |
| | Personal computer preventive maintenance overview | |
| | Apply Troubleshooting Process to Computer Components and Peripherals | 4 |
| | Setting a computer system in BIOS Setup | |
| | Interaction of the automatic control system with the automatic diagnostic system. POST. | |
| | **5. Networking Concepts** | |
| | Network Components and Types | |
| | Physical components of networks. | |
| | Topologies of local networks. | 5 |
| | Network Devices | |
| | Device to Network Connection | |
| | Basic Troubleshooting Process for Networks | |
| | **6. System and application software** | |
| | Operating Systems. | |
| | Operating shells. | |
| ПР18.3-Б3 | Programming languages. | 7 |
| | Drivers and utilities. | |
| | General and special purpose programs. | |
| | Service applications. | |
| | Basic Troubleshooting Process for operation systems. | |
| ПР18.4-Б3 | **7. Algorithmization of computational processes** | 7 |

| Ciphers ДРН | Types and topics of training sessions | Hours |
|---|---|---|
| | The concept of algorithm and its main properties | |
| | Basic concepts of algorithmization of computational processes | |
| | Variants to set algorithms | |
| | Structures of algorithms | |
| | Examples of ways to solve algorithm structures | |
| | Examples of solving problems for compiling algorithms | |
| **LABORATORY WORKS** | | **35** |
| ПР18.1-Б3<br>ПР18.3-Б3<br>ПР18.4-Б3<br>ПР18.5-Б3 | 1. Basic components of a personal computer in HWINFO64 | 5 |
| | 2. Components on the motherboard. | 4 |
| | 3. Build a Specialized Computer System. | 4 |
| | 4. Diagnostic Software. | 4 |
| | 5. Boot the Computer. | 4 |
| | 6. BIOS Setup Utility and Common Trouble Shooting | 4 |
| | 7. Configure Computer Network | 5 |
| | 8. Numbering systems | 5 |
| | **PRACTICAL WORKS** | **16** |
| ПР18.1-Б3<br>ПР18.2-Б3 | **1. Study of the purpose, scheme and principles of operation of systems (components) of PC components and consideration of their main characteristics:**<br>– the Motherboard;<br>– CPU;<br>– Types of Memory;<br>– HDD, SSD;<br>– Power supply system;<br>– Cooling Systems;<br>– Input and output system;<br>– PC peripherals. | 2 |
| | **2. Complete the Computer Assembly.** | 4 |
| | **3. Disassemble a Computer.** | 4 |
| | **4. Complete the Laptop Assembly.** | 4 |
| | **5. Disassemble a Laptop.** | 2 |
| | **TOTAL** | **89** |
| ***2 semester*** | | |
| **LECTURES** | | **33** |
| ПР06.1-Б3<br>ПР06.2-Б3<br><br>ПР18.5-Б3 | **1. Basic concepts of computer programming** | 6 |
| | Features of programming technology | |
| | Object-oriented programming | |
| | Types and composition of programming systems | |
| | Coding data in a computer (examples of solving problems on coding information) | |
| | **2. Introduction to the C ++ programming language** | 6 |

| Ciphers ДРН | Types and topics of training sessions | Hours |
|---|---|---|
| | General characteristics of language | |
| | Software development technology | |
| | Alphabet and identifiers | |
| | Operations, expressions and operators | |
| | Classification of data types | |
| | Values in C++ | |
| | The task of constants | |
| | Existence time and scope of variables | |
| | **3. Branch programming** | 6 |
| | Development of structured programs | |
| | Conditional instructions: if, else, switch | |
| | Examples of using the if and switch case operators | |
| | **4. Loops programming** | 8 |
| | The '***while'*** loop | |
| | The '***do ... while'*** loop | |
| | The ***for*** statement | |
| | Examples of using loop operators. | |
| | Nested loops | |
| | Recommendations for choosing loops | |
| | Control operators in loops | |
| | Examples of using loops | |
| | **5. Arrays** | 7 |
| | Declaring and initializing arrays | |
| | One-dimensional and two-dimensional arrays | |
| | Examples of using arrays | |
| | **LABORATORY WORKS** | **28** |
| ПР06.1-Б3<br>ПР18.5-Б3 | 1. Introduction to Microsoft Visual Visual C++. Types of projects. Creating a project in Microsoft Visual Studio | 3 |
| | 2. Algorithms. basic concepts and properties | 4 |
| | 3. Programming of linear algorithms | 3 |
| | 4. Development of structured programs | 6 |
| | 5. Development of the program with loop process | 6 |
| | 6. Development of a program with one-dimensional and two-dimensional arrays. Search for elements, sort arrays | 6 |
| | **TOTAL** | **61** |
| | **TOTAL (1st and 2d semesters))** | **150** |

# 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 NTUDP students***

| Rating | Institutional |
|---|---|
| 90 ... 100 | Excellent |
| 74 ... 89 | Good |
| 60 ... 73 | Satisfactory |
| 0 ... 59 | Failed |

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 NTUDP.

## 6.2 DIAGNOSTIC TOOLS AND EVALUATION PROCEDURES

The content of diagnostic tools is aimed at controlling the level of knowledge, skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 7th 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 intermediate and final knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the intermediate and final knowledge progress testing are approved by the appropriate department.

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

*Diagnostic and assessment procedures*

| INTERMEDIATE CONTROL | | | FINAL 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;<br><br>CCW performance during the examination at the request of the student |
| practical | control tasks for each topic | tasks during practical classes | | |
| | or individual task | tasks during independent work | | |
| Laboratory | control tasks for each topic or individual task | performing tasks during independent work | | |

During the intermediate control, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Practical classes are assessed by the quality of the control or individual task.

If the content of a particular type of teaching activity is subordinated to several descriptors, then the integral value of the assessment may be determined by the weighting coefficients set by the lecturer.

Provided that the level of results of the intermediate controls of all types of training at least 60 points, the final control 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 intermediate control, every student during the final knowledge progress testing has the right to perform the CDF, which contains tasks covering key disciplinary learning outcomes.

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

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

The integral value of the CDF performance assessment can be determined by taking into account the weighting factors established by the department for each NLC descriptor.

## 6.3 EVALUATION CRITERIA

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

To evaluate the performance of the control tasks during the intermediate control of lectures and practicals the assimilation factor is used as a criterion, which automatically adapts the indicator to the rating scale:

$$O_i = 100 \text{ a / m},$$

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 competencies identified by the NLC for the Bachelor's level of higher education (given below).

**Integral competence** is the ability to solve complex problems and specialized practical problems in a particular area of professional activities or in a learning process that involves the use of certain theories and methods of the relevant scientific areas and characterized by complexity and conditions uncertainty.

***General criteria for achieving learning outcomes for the 6th qualification level according to the NLC***

| **descriptors NLC** | **Requirements for knowledge, communication, autonomy and responsibility** | **Indicator evaluation** |
|---|---|---|
| **Knowledge** | | |
| ♦ Conceptual knowledge acquired during the training and professional activities, including some knowledge of modern achievements;<br>♦ critical understanding of the main theories, principles, methods, and concepts in education and careers | - A great - proper, reasonable, sensible. Measures the presence of: - conceptual knowledge; - a high degree of state ownership issues; - critical understanding of the main theories, principles, methods and concepts in education and careers | 95-100 |
| | A non-gross contains mistakes or errors | 90-94 |
| | The answer is correct but has some inaccuracies | 85-89 |
| | A correct some inaccuracies but has also proved insufficient | 80-84 |
| | The answer is correct but has some inaccuracies, not reasonable and meaningful | 74-79 |
| | A fragmentary | 70-73 |
| | A student shows a fuzzy idea of the object of study | 65-69 |
| | Knowledge minimally satisfactory | 60-64 |
| | Knowledge unsatisfactory | <60 |
| **Ability** | | |
| ♦ solving complex problems and unforeseen problems in specialized areas of professional and/or training, which involves the collection and interpretation of information (data), | - The answer describes the ability to:<br>- identify the problem;<br>- formulate hypotheses;<br>- solve problems;<br>- choose adequate methods and tools;<br>- collect and interpret logical and understandable information;<br>- use innovative approaches to solving the problem | 95-100 |
| | The answer describes the ability to apply knowledge in | 90-94 |

| descriptors NLC | Requirements for knowledge, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| choice of methods and tools, the use of innovative approaches | practice with no blunders | |
| | The answer describes the ability to apply knowledge in practice but has some errors in the implementation of a requirement | 85-89 |
| | The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the two requirements | 80-84 |
| | The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the three requirements | 74-79 |
| | The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the four requirements | 70-73 |
| | The answer describes the ability to apply knowledge in practice while performing tasks on the model | 65-69 |
| | A characterizes the ability to apply knowledge in performing tasks on the model, but with uncertainties | 60-64 |
| | The level of skills is poor | <60 |
| **Communication** | | |
| ♦ report to specialists and non-specialists of information, ideas, problems, solutions and their experience in the field of professional activity;<br>♦ the ability to form an effective communication strategy | - Fluent problematic area. Clarity response (report). Language - correct;<br>- - net;<br>- - clear;<br>- - accurate;<br>- - logic;<br>- - expressive;<br>- - concise.<br>Communication strategy:<br>coherent and consistent development of thought;<br>availability of own logical reasoning;<br>relevant arguments and its compliance with the provisions defended;<br>the correct structure of the response (report);<br>correct answers to questions;<br>appropriate equipment to answer questions;<br>the ability to draw conclusions and formulate proposals | 95-100 |
| | Adequate ownership industry issues with minor faults. Sufficient clarity response (report) with minor faults. Appropriate communication strategy with minor faults | 90-94 |
| | Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total three requirements are not implemented) | 85-89 |
| | Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (a total of four requirements is not implemented) | 80-84 |
| | Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total not implemented the five requirements) | 74-79 |
| | Satisfactory ownership issues of the industry. Satisfactory | 70-73 |

| descriptors NLC | Requirements for knowledge, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | clarity response (report) and relevant communication strategy (a total of seven requirements not implemented) | |
| | Partial ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented nine requirements) | 65-69 |
| | The fragmented ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented 10 requirements) | 60-64 |
| | The level of poor communication | <60 |
| **Autonomy and responsibility** | | |
| ♦ management actions or complex projects, responsible for decision-making in unpredictable conditions;<br>♦ responsible for the professional development of individuals and/or groups<br>♦ the ability to continue study with a high degree of autonomy | - Excellent individual ownership management competencies focused on:<br>1) management of complex projects, providing:<br>- exploratory learning activities marked the ability to independently evaluate various life situations, events, facts, detect and defend a personal position;<br>- the ability to work in a team;<br>- control of their own actions;<br>2) responsibility for decision-making in unpredictable conditions, including:<br>- justify their decisions the provisions of the regulatory framework of sectoral and national levels;<br>- independence while performing tasks;<br>- lead in discussing problems;<br>- responsibility for the relationship;<br>3) responsible for the professional development of individuals and/or groups that includes:<br>- use of vocational-oriented skills;<br>- the use of evidence from independent and correct reasoning;<br>- possession of all kinds of learning activities;<br>4) the ability to further study with a high degree of autonomy, which provides:<br>- degree possession of fundamental knowledge;<br>- independent evaluation judgments;<br>- high level of formation of general educational skills;<br>- search and analysis of information resources | 95-100 |
| | Confident personality possession competency management (not implemented two requirements) | 90-94 |
| | Good knowledge management competencies personality (not implemented three requirements) | 85-89 |
| | Good knowledge management competencies personality (not implemented the four requirements) | 80-84 |
| | Good knowledge management competencies personality (not implemented six requirements) | 74-79 |
| | Satisfactory ownership of individual competence management (not implemented seven requirements) | 70-73 |
| | Satisfactory ownership of individual competence management (not implemented eight claims) | 65-69 |
| | The level of autonomy and responsibility fragmented | 60-64 |

| descriptors NLC | Requirements for knowledge, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | The level of autonomy and responsibility poor | <60 |

## 7 TOOLS, EQUIPMENT, AND SOFTWARE

The laboratory and instrumental base of the graduating department of information technologies and computer engineering:

- HWINFO64;
- MS Visual Studio Community 2019;
- LibreOffice 6.4;
- Windows 10;
- MS Office 365;
- Virtual Desktop;
- Virtual Laptop;
- computer and multimedia equipment are used;
- distance learning platform Moodle, MS Teams.

.

## 8 RECOMMENDED BIBLIOGRAPHY

### 1 semester


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Educational edition

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for bachelors
141 Electric Power Engineering, Electrical Engineering and Electromechanics

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Prepared for publication
Dnipro University of Technology.
Certificate of registration in the State Register, control number 1842
49005, Dnipro, Dmytra Yavornytskoho Ave. 19