National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department of Automation of Energy Systems of the FEA

Computer Technology and Programming. Part 1. Fundamentals of Computing and Programming

Working program of the academic discipline (Syllabus)

Details of the academic discipline	
Level of higher education	***First (Bachelor)***
Discipline	*14 "Electrical engineering"*
Specialty	*141 "Electric power engineering, electrical engineering and electromechanics"*
Educational program	*Management, protection and automation of energy systems, Electric systems and networks, Non-traditional and renewable energy sources, Electric stations, Electrotechnical devices and electrotechnological complexes, Electric machines and devices, Electromechanical automation systems, electric drives and electric mobility.*
Discipline status	*Cycle of general training. Mandatory components of the educational program*
Form of education	*Eye (day) and eye (day) accelerated*
Year of training, semester	*1st year, fall semester*
Scope of the discipline	*165 hours / 5.5 ECTS credits | (36 hours of lectures, 36 hours of laboratory work, 18 hours of practical classes)*
Semester control/ control measures	*Exam / MKR / DKR*
Class schedule	*http://rozklad.kpi.ua/* *1 lecture (2 hours) once a week;* *1 laboratory work (2 hours) once a week;* *1 practical lesson (2 hours) once every two weeks.*
Language of teaching	*Ukrainian*
Information about the head of the course / teachers	Lecturers: *Ph.D. Assoc. Artem Borisovych Nesterko, nesterko-fea@lll.kpi.ua ,* *c t. excl. Nastenko Dmytro Vasyliovych, nastenko - fea @ lll . kpi u.a* Practical: *Ph.D. Oleg Shpolianskyi, shpolianskyi-fea@lll.kpi.ua* Laboratory: *Tymokhina Anastasia Oleksandrivna timokhina-fea@lll.kpi.ua,* Hulyi Volodymyr Serhiyovych hulyi-fea@lll.kpi.ua , Bogomolova Oksana Serhiivna bohomolova-fea@lll.kpi.ua
Placement of the course	*Google Classroom* *and* *site https://sites.google.com/view/programming-fea*

Program academic discipline

1. Description educational discipline, its purpose, subject of study and learning outcomes

The program of the academic discipline "Computer technology and programming. Part 1" was compiled in accordance with the educational and professional training program for bachelors in the field of knowledge 14 "Electrical engineering" with the specialty 141 "Electric power engineering, electrical engineering and electromechanics", educational programs: Management, protection and automation of power systems, Electrical systems and networks, Non-traditional and renewable sources energy, Electric stations, Electrotechnical devices and electrotechnological complexes, Electric machines and devices, Electromechanical automation systems, electric drive and electromobility..

The goal of the educational discipline is the formation and consolidation of the following competencies in students *: K02. Ability to apply knowledge in practical situations; K06. Ability to identify, pose and solve problems; K08. Ability to work autonomously; K11. The ability to solve practical problems using automated design and calculation systems (CAD).*

The subject of the educational discipline *is the basic principles of programming and the creation of algorithms for solving applied problems. Familiarity with the C # programming language and the basic structures and classes of the environment. Net . Work with branching operators and iteration loops. Methods of processing scalar data, one-dimensional and multi-dimensional, rectangular and toothed arrays.*

Program learning outcomes, the formation and improvement of which is aimed at the discipline:
PR06. Apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities.
PR18. Be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.

At the beginning of the study of the discipline, each student should be familiarized with the program of the discipline and forms of organization of study, as well as with all types of control and methods of knowledge assessment.

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

Discipline "Computer technology and programming. Part 1" is a basic discipline and is required for successful mastering of such disciplines as: "Computer technology and programming-2", "Computational methods and algorithmization", "Mathematical problems of energy engineering", "Packages of application programs for personal computers", "Relay protection and automation power systems", "Theory of automatic control", etc. and further qualitative research on the topic of certification work.

In order to successfully master the discipline, the student must know English at a basic level and mathematics within the school curriculum and partially "Higher Mathematics 1".

3. Content of the academic discipline

The discipline is structurally divided into ***4 sections*** *, namely:*

1. ***Basics of algorithmization and programming*** *(The concept of an algorithm, its properties, basic elements of building algorithms. Programming languages and areas of their use)*
2. ***Data objects and the basic principles of their processing*** *(Basic elements of the C# programming language. Data types. Console input and output operations. Expressions and arithmetic operators. Type conversion and conversion. Symbolic data type. Text strings. Working with string data.)*
3. ***The main constructs of the C # programming language*** *(Branching operators. Conditional if statement and multiple selection switch statement. Iterative designs. The for loop. while and do / while. Algorithms using nested loops.)*
4. ***Working with arrays*** *(Initialization of arrays. Iterative constructions. The foreach loop. Filling arrays using a random number generator. Basic principles of using the System class. A rray. Principles of data processing in one-dimensional arrays. Methods of sorting and searching data. Using the split and join methods when working with strings. Multidimensional rectangular arrays. Step arrays.)* **.**

4. Educational materials and resources

Main information resources:

1. *Nastenko, D. V. Object-oriented programming. Part 1. Basics of object-oriented programming in the C# language [Electronic resource]: a study guide for bachelors of the training area 6.050701 "Electrical engineering and electrical technologies" of the vocational program "Management systems for production and distribution of electricity" / D. V. Nastenko, A. B. Nesterko; NTUU "KPI". – Electronic text data (1 file: 931.2 KB). - Kyiv: NTUU "KPI", 2016. - 76 p. – Title from the screen. https://ela.kpi.ua/hand l e/123456789/16671*
2. *Computer technology and programming. Synopsis of lectures. Part 1 [Electronic resource]: study guide for students of specialty 141 "Electroenergetics, electrical engineering and electromechanics" / KPI named after Igor Sikorskyi; editor: G. O. Trunin, D. V. Nastenko, A. B. Nesterko. – Electronic text data (1 file: 3.28 MB). – Kyiv: KPI named after Igor Sikorskyi, 2020. – 117 p. – Title from the screen. https://ela.kpi.ua/handle/123 4 56789/39004*
3. *Computer technology and programming. Laboratory work. Part 1 [Electronic resource]: study guide for students of specialty 141 "Electroenergetics, electrical engineering and electromechanics" / KPI named after Igor Sikorskyi; editor: A. B. Nesterko, D. V. Nastenko, G. O. Trunin. – Electronic text data (1 file: 1.99 MB). – Kyiv: KPI named after Igor Sikorskyi, 2020. – 83 p. – Title from the screen. https://ela.kpi.ua/handle/12345 6 789/39020*
4. *Computer technology and programming. Home control work. Part 1 [Electronic resource]: study guide for students of specialty 141 "Electroenergetics, electrical engineering and electromechanics" / KPI named after Igor Sikorskyi; compiled by: D. V. Nastenko, G. O. Trunin, A. B. Nesterko – Electronic text data (1 file: 1.31 MB). – Kyiv: KPI named after Igor Sikorskyi, 2020. - 17 p. – Title from the screen. https://ela.kpi.ua/handle/1234567 8 9/39019*
5. *Computer technology and programming [Electronic resource]: Workshop (Part 1) for students of specialty 141 Electric power, electrical engineering and electromechanics / KPI named after Igor Sikorskyi; Compiler: G. O. Trunin, D. V. Nastenko, A. B. Nesterko. – Electronic text data (1 file, pdf: 641 KB). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 49 p. - Title from the screen. https://ela.kpi.ua/handle/123456789/48837*
6. *Thomas G. Corman, Charles E. Leitherson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms. — K.: K. I. S., 2019. — 1288 p. ISBN 978-617-684-239-2*

Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

No s/p	*The name of the topic of the lecture and a list of main questions (list of didactic tools, links to information sources)*
	Chapter 1. Basics of algorithmization and programming
1	*CONCEPT OF ALGORITHM, ITS PROPERTIES, BASIC ELEMENTS OF ALGORITHM CONSTRUCTION. PROGRAMMING LANGUAGES AND AREAS OF THEIR USE.* *1.1. Concept of algorithmization and algorithm.* *1.2. Properties of algorithms* *1.3. Methods of describing algorithms. Programs* *1.4. Programming languages* *Literary sources: [1, 2, 5]*
	Section 2 . Data objects and basic principles of their processing
2.	*BASIC ELEMENTS OF THE C# PROGRAMMING LANGUAGE. TYPES OF DATA. CONSOLE INPUT AND OUTPUT OPERATIONS.* *2.1. Components of programming languages* *2.2. Comments* *2.3. Data types* *2.4. Variables and constants* *2.5. Input and output using System.Console* *2.6. Formatted output*

	Literary sources : [1, 2, 5]
3.	*EXPRESSIONS AND ARITHMETIC OPERATORS.* *3.1. C# Expressions* *3.2. Simple C# Statements* *3.3. Increment and decrement* *3.4. Denial operations* *3.5. Explicit type conversion* *3.6. Multiplication, division and remainder from division* *3.7. Addition and subtraction* *3.8. Relational operations and equality checks* *3.9. Conditional logical operations* *3.10. Conditional ternary operator* *3.11. Assignment operations* *3.12. Mathematical functions - class Math* *Literary sources : [1, 2, 5]*
4 .	*CONVERSION AND TRANSFORMATION OF TYPES.* *4.1. Features of conversion of basic data types* *4.2. Types of transformations* *4.3. Implicit transformations* *4.4. Explicit transformations (casts)* *4.5. Transformation using helper classes* *Literary sources : [1 , 2 , 5]*
5.	*SYMBOL DATA TYPE. TEXT LINES. WORKING WITH STRING DATA.* *5.1. Character data type* *5.2. Lines of type string* *5.3. Control sequences* *5.4. Basic elements of the System.String class* *5.5. String interpolation in C#* *5.6. System.Text.StringBuilder class* *Literary sources: [1, 2, 5]*
	Chapter 3. Basic constructs of the C # programming language
6.	*BRANCH OPERATORS. CONDITIONAL OPERATOR IF AND MULTIPLE SELECTION OPERATOR SWITCH.* *6.1. Conditional statement if* *6.2. Logical expressions* *6.3. Comparison of real numbers* *6.4. The switch selection operator* *Literary sources : [1 , 2 , 5]*
7.	*Iterative constructions. FOR CYCLE* *7.1. Loop operators* *7.2. A loop with a for parameter* *7.3. Examples of using the for loop* *Literary sources : [1 , 2 , 5]*
8.	*Iterative constructions. WHILE AND DO / WHILE LOOPS* *8.1. The while statement* *8.2. Finding the greatest common divisor* *8.3. The do ... while statement* *8.4. Method of dividing by half (Dichotomy)*

	8.5. Transition operators (control transfers) *8.6. The goto operator* *8.7. The break and continue operators* *Literary sources : [1 , 2 , 5]*
9.	*ALGORITHMS USING NESTED LOOPS* *9.1. Finding the greatest divisor* *9.2. Finding the sum of a series* *Literary sources : [1 , 2 , 5]*
	Chapter 4. Working with arrays
10.	*ARRAYS. INITIALIZATION OF ARRAYS* *10.1. The concept of an array* *10.2. Initialization of one-dimensional arrays* *10.3. Indexing of elements of a one-dimensional array* *10.4. Examples of using arrays* *Literary sources : [1 , 2 , 5]*
11.	*Iterative constructions. FOREACH CYCLE* *11.1. foreach...in loop* *Literary sources: [1, 2, 5]*
12.	*ARRAYS. FILLING OF ARRAYS USING THE RANDOM NUMBER GENERATOR. BASIC PRINCIPLES OF USING THE SYSTEM.ARRAY CLASS* *12.1. Random class* *12.2. Array class* *12.3. The foreach loop* *12.4. Array class methods* *Literary sources : [1 , 2 , 5]*
13.	*PRINCIPLES OF DATA PROCESSING IN ONE-DIMENSIONAL ARRAYS. DATA SORTING AND SEARCH METHODS* *13.1. Bubble sorting* *13.2. Insert sort* *Literary sources : [1 , 2 , 5]*
14.	*USING THE SPLIT AND JOIN METHODS WHEN WORKING WITH STRINGS.* *14.1. Split method* *14.2. The Join method* *14.3. Examples of using Split and Join* *Literary sources : [1 , 2 , 5]*
15.	*MULTIDIMENSIONAL RECTANGULAR ARRAYS.* *15.1. Two-dimensional rectangular arrays* *15.2. Properties and methods of matrices* *Literary sources : [1 , 2 , 5]*
16	*MULTIDIMENSIONAL RECTANGULAR ARRAYS.* *1 6 . 1 . Examples of work with two-dimensional rectangular arrays* *16.2. Rectangular arrays of three or more dimensions* *Literary sources : [1 , 2 , 5]*
1 7 .	*STEP ARRAYS.* *1 7.1. Two-dimensional stepped arrays* *17.2. Initialization of stepped arrays* *1 7 .3. Examples of the use of stepped arrays* *Literary sources : [1 , 2 , 5]*
18	*MKR .*

Practical classes

No s/p	*Topics of practical classes*	*Number audio hours*
1	*Development of an elementary program in the C# programming language*	*2*
2	*Programming of arithmetic expressions*	*2*
3	*Work with text strings*	*2*
4	*The if/else branching statement*	*2*
5	*The switch/case multiple selection operator*	*2*
6	*Loop operators. Part 1. The for loop*	*2*
7	*Loop operators. Part 2. While and do/while loops*	*2*
8	*One-dimensional arrays*	*2*
9	*Two-dimensional arrays. The basics of working with matrices*	*2*
	IN GENERAL	*18*

Laboratory classes

No s/p	*The name of the laboratory work*	*Number audio hours*
1	*Familiarity with the Visual Studio environment. Development of an elementary program in the C# programming language* *Literary sources: [3]*	*2*
2	*Basic data types. Formatting console output* *Literary sources: [3]*	*2*
3	*Programming of arithmetic expressions* *Literary sources: [3]*	*2*
4	*Work with text strings.* *Part 1. Basic operations with strings* *Literary sources: [3]*	*2*
5	*Work with text strings.* *Part 2. Advanced possibilities for working with strings* *Literary sources: [3]*	*2*
6	*The if/else branching statement* *Literary sources: [3]*	*2*
7	*The switch/case multiple selection operator* *Literary sources: [3]*	*4*
8	*Loop operators. Part 1. The for loop* *Literary sources: [3]*	*4*
9	*Loop operators. Part 2. While and do/while loops* *Literary sources: [3]*	*4*
10	*One-dimensional arrays. Part 1. Basic operations with arrays* *Literary sources: [3]*	*4*
11	*One-dimensional arrays. Part 2. Principles of data processing in one-dimensional arrays* *Literary sources: [3]*	*4*
12	*Two-dimensional arrays. The basics of working with matrices* *Literary sources: [3]*	*4*
	IN GENERAL	*36*

6. Independent work of students

No. z/p	*Type of independent work*	*Number*

		hours of SRS
1	*Preparation for classroom classes* *Literary sources: [1-5]*	*33*
2	*Preparation for MKR* *Literary sources: [4]*	*5*
3	*Preparation for the DKR on the topic " Using the C# algorithmic language for mathematical modeling of complex arithmetic problems and methods "* *Literary sources: [4]*	*7*
4	*Preparation for the exam*	*30*
	IN GENERAL	*75*

Policy and control

7. Policy of academic discipline (educational component)

The system of requirements that the teacher sets before the student:

- *rules for attending classes: in accordance with Order 1-273 dated 14.09.2020, it is prohibited to evaluate the presence or absence of the winner at the classroom class, including the awarding of incentive or penalty points.*
- *rules of behavior in classes: the student has the opportunity to receive points for the appropriate types of educational activity in lectures and laboratory classes, provided by the RSO of the discipline. The use of means of communication to search for information on the Internet, in a distance course on the Sikorsky platform is carried out under the condition of the instruction of the teacher;*
- *rules for the protection of individual tasks: the defense of the DCR in the discipline is carried out individually and only in the event that the student does not agree with the points awarded based on the results of the DCR check (provided that the calendar plan for the DCR is followed);*
- *rules for assigning incentive and penalty points: incentive and penalty points are not included in the main scale of RSO, and their sum does not exceed 10% of the starting scale. Incentive points are awarded for participation in faculty and institute Olympiads and scientific conferences. Penalty points are awarded for late submission of laboratory works and DKR by the student.*
- *policy of deadlines and rescheduling: late completion of DCR and laboratory works involves the accrual of penalty points. If the student did not pass or did not appear for the MKR, his result is evaluated at 0 points. Recompilation of MKR results is not provided for;*
- *policy on academic integrity: the Code of Honor of the National Technical University of Ukraine "Kyiv Polytechnic Institute" https://kpi.ua/files/honorcode.pdf establishes general moral principles, rules of ethical behavior of individuals and provides a policy of academic integrity for persons working and studying at the university, which they should be guided by in their activities, including when studying and preparing control measures in the discipline "Computer technology and programming. Part 1"*
- *when using digital means of communication with the teacher (mobile communication, e-mail, correspondence on forums and social networks, etc.), it is necessary to observe generally accepted ethical norms, in particular, be polite and limit communication to the working hours of the teacher.*

8. Types of control and rating system for evaluating learning outcomes (RSO)

Current control *: MKR, DKR.*
Calendar control *: is carried out twice a semester as a monitoring of the current state of fulfillment of the syllabus requirements.*
Semester control *: exam*
Conditions for admission to the semester control *: positive grades (>59 points) for each of the 12 laboratory works and DKR.*
Table of correspondence of rating points to grades on the university scale:

Number of points	Rating
100-95	Perfectly
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily

The overall rating of the student after the end of the semester consists of points, received for:

- *performance of laboratory work;*
- *performance of home control work (DKR);*
- *execution of modular control work (MCR).*

Performance and protection of laboratory work	DKR	MKR	Rs	Rec	R
40	7	13	60	40	100

1. Laboratory works (12 works), for each work:

Each laboratory work is evaluated on a 100-point scale. 40% of the grade for laboratory work consists of answers to 10 test questions (4 points for a correct answer) and 60% of the task of writing a program and design/defense of a report.

For untimely submission of the report, 3 penalty points are charged for each week of delay (1..7 days after the deadline specified by the teacher - 3 points, 8..14 days - 6 points, etc.).

For each work, a student can receive:

- *"excellent" - 95-100 points, complete completion of the task and answer to control questions (at least 90% of the required information);*
- *"good" - 75-84 points and "very good" 85-94 points, answers to the vast majority of test questions are given, and the work contains insignificant errors in the execution and design of the report;*
- *"sufficient" - 60-64 points and "satisfactory" - 65-74 points, many errors in the answers to test questions, significant errors when solving the task (program), and when drawing up the protocol and building block diagrams of the program's algorithms;*
- *"unsatisfactory" - 0 points, the student did not score the required number of points for a positive assessment or did not pass the work. This means that the work must be completed within the deadlines set by the educational schedule.*

At the end of the semester, for 12 passed laboratory works, the average arithmetic value is found ((L1+L2+…+L12)/12, where L1,L2,…,L12 are grades for the corresponding works), the obtained value is multiplied by a factor of 0.4, i.e. it is converted into points RSO from 24 to 40 points.

2. Modular control work. It consists of answers to test questions.

It is evaluated on a 100-point scale. It consists of answers to test questions and displays the percentage of correct answers to test questions.

Scored points at the end of the semester are recalculated with a coefficient of 0.13, which gives from 0 to 13 points of RSO.

3. Home control work

It is evaluated on a 100-point scale. It consists of answers to test questions and displays the percentage of correct answers to test questions. For untimely submission of the report, 3 penalty points are charged for each week of delay (1..7 days after the deadline specified by the teacher - 3 points, 8..14 days - 6 points, etc.).

- *"excellent" - 95-100 points, complete completion of the DKR task and answer to control questions (at least 90% of the required information);*
- *"good" - 75-84 points and "very good" 85-94 points, answers to the vast majority of test questions are given, and the work contains insignificant errors in the execution and design of the report;*
- *"sufficient" - 60-64 points and "satisfactory" - 65-74 points, many errors in the answers to test questions, significant errors when solving the task (program), and when drawing up the protocol and building block diagrams of the program's algorithms;*
- *"unsatisfactory" - 0 points, the student did not score the required number of points for a positive assessment or did not pass the work. This means that the work must be completed within the deadlines set by the educational schedule.*

These points at the end of the semester are recalculated with a coefficient of 0.07, which gives from 4 to 7 points of RSO.

4. ***Work in practical classes***

Students may be awarded additional incentive points for active work in practical classes. A maximum of 5 points in total for all classes.

5. ***Total grade for work during the semester***

It consists of the sum of RSO points for laboratory work, DKR and MKR. A maximum of 40+7+13=60, and incentive points. At the end of the semester, there is a semester control in the form of an exam.

The form of semester control is an exam

Only those students who have passed 12 laboratory works and DKR are admitted to the exam. The examination paper consists of answers to one theoretical (10 RSO points) and two practical questions (15 RSO points each)

Evaluation criteria of the exam

*Rating Rs ≥ 0.6*R, i.e. 60 points – is counted automatically.*
*Rating Rs within (0.4 - 0.59)*R, i.e. 40 - 59 points - students pass the exam.*
The maximum rating of the exam Rz = 40 points.
Exam rating Rz = 33 – 40 points – the student gave comprehensive answers to all questions (and additional ones if necessary), gives clear definitions of all concepts, programs and algorithms are logical and consistent.
Exam rating Rz = 25 – 32 points – when answering questions, the student makes some mistakes, but can correct them with the help of the teacher; knows the definition of the main concepts of the discipline, generally understands the essence of algorithmization and programming in the C # language.
Exam rating Rz = 16 – 24 points – the student partially answers the exam questions, shows knowledge, but does not sufficiently understand the essence of algorithmization and programming processes. The answers are inconsistent and unclear.
Exam rating R out of ≤15 points - the student makes significant mistakes in the answer, shows a lack of understanding of the physical essence of algorithmization and programming processes, cannot correct mistakes with the help of the teacher. The answers are incorrect, and in some cases do not correspond to the essence of the question.

9. Additional information on the discipline (educational component)

List of topics that are submitted for semester control

All topics from the list of lectures and practical tasks are similar to those performed in laboratory work during the semester.

***Certificates of completion of distance or online courses on the relevant subject may be credited subject to the fulfillment of the requirements specified in** ORDER NO. 7-177 DATED 01.10.2020 ON APPROVAL OF THE REGULATION ON RECOGNITION IN KPI NAMED AFTER IGOR SIKORSKYI OF LEARNING OUTCOMES ACQUIRED IN NON-FORMAL/INFORMAL EDUCATION*

Working program of the academic discipline (syllabus)
made by Art. teacher of the faculty AE Nastenko D.V. and Ph.D., Assoc. Nesterko A.B.

Approved by the Department of Automation of Energy Systems of the FEA (protocol No. 11 from 26.06.2023)
Agreed by the Methodical Commission of the faculty (protocol No. 10 dated June 16, 2024)