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

Department of Automation of Energy Systems of the FEA

Computer Technology and Programming. Part 2. Application Development in High-level Programming Languages

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, spring 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	*Credit / MKR*
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 course leader / teachers	*Lecturers: Ph.D. Assoc. Artem Borisovych Nesterko, nesterko-fea@lll.kpi.ua,* *ct. off Nastenko Dmytro Vasyliovych, nastenko-fea@lll.kpi.ua* *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 of educational discipline

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

The program of the academic discipline "Computer technology and programming. Part 2" 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 .Net environment. Learning the basics of OOP. Work with classes, objects, fields, methods, modifiers, etc.*

Program learning outcomes, the formation and improvement of which is aimed at the discipline:
PR0 6 . 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)

The basic discipline for "Computing technology and programming-2" is the discipline "Computing technology and programming-1"

In turn, the discipline "Computer technology and programming. Part 2" is a basic discipline and is required for successful mastering of such disciplines as: "Fundamentals of object-oriented programming", "Computational methods and algorithmization", "Mathematical problems of power engineering", "Packages of application programs for PCs", "Relay protection and automation of energy 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 **3 sections** , namely:*

1. ***Objects and classes** (Concepts of class and object, fields and methods. Basics of OOP. Access level modifiers. Constructors. Properties.)*
2. ***Interfaces and collections** (Concept of interface. Use of interfaces. Interfaces IComparable and IComparable<Type>. Operators is and as. C# collections. System.Collections namespace.)*

3. ***Working with the .NET base class library*** *(System.IO namespace. File input output. Object serialization. Creating a Windows Forms project. Types of control elements and work with them. Introduction to the GDI + interface. Construction of graphs of functions.)*

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/handle/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/123456789/39004*
3. *Computing and programming [Electronic resource]: Laboratory practice (Part 2). For students of specialty 141 Electric power, electrical engineering and electromechanics / KPI named after Igor Sikorskyi; Compiler: D. V. Nastenko, A. B. Nesterko, G. O. Trunin. – Electronic text data (1 file, pdf: 843 KB). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 83 p. - Title from the screen. https://ela.kpi.ua/handle/123456789/48839*
4. *Methodical instructions and tasks for the performance of homework control work in the discipline "Computer technology and programming. Part 2" for students of specialty 141 Electric power, electrical engineering and electromechanics [Electronic resource] / NTUU "KPI" ; D. V. Nastenko, A. B. Nesterko, G. O. Trunin. – Electronic text data (1 file: 1.09 MB). - Kyiv: NTUU "KPI", 2016. - 15 p. – Title from the screen. https://ela.kpi.ua/handle/123456789/25004*
5. *Computer technology and programming [Electronic resource]: Workshop (Part 2) for students of specialty 141 Electric power, electrical engineering and electromechanics / KPI named after Igor Sikorskyi; Compiler: A. B. Nesterko, G. O. Trunin, D. V. Nastenko. – Electronic text data (1 file, pdf: 906 KB). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 66 p. - Title from the screen. https://ela.kpi.ua/handle/123456789/48838*
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. Objects and classes
1	*INTRODUCTION TO OOP. CLASSES AND OBJECTS.* *1.1. Basic concepts. Three basics of OOP* *1.2. Interpolation* *1.3. Creation of the object operator new* *1.4. Assignment of objects. The value is null* *Literary sources: [1, 2, 5]*

	Optional: Custom data types. Structures. Differences between classes and structures. Examples of standard structures: int, double, DateTime, TimeSpan
2.	*FIELDS AND METHODS. ACCESS LEVEL MODIFIERS* *2.1. fields* *2.2. Access level modifiers* *2.3. Summary of methods* *2.4. Inheritance on the example of System.Object* *2.5. Polymorphism. Overloading by example on the ToString() method example.* *2.6. Partial classes* *Literary sources: [1, 2, 5]*
3.	*CONSTRUCTORS* *3.1. Concept of constructor* *3.2. Constructor overloading* *3.3. Using this* *3.4. The readonly modifier* *Literary sources: [1, 2, 5]* *Additionally:* *Inheritance creates a hierarchy of own classes. Using the base keyword.*
4.	*METHODS* *4.1. Details about the methods* *4.2. Keywords void and return* *4.3. Types of parameter transfer. ref , out and params* *4.4. Method overloading* *4.5. Static fields, methods.* *Literary sources: [1, 2, 5]*
5.	*PROPERTIES* *5.1. The concept of properties* *5.2. Read-only, write-only properties* *5.3. Automatic properties* *5.4. Indexers* *Literary sources: [1, 2, 5]* *Additionally:* *Enumeration enum*
6.	*STATIC COMPONENTS. DESTRUCTORS* *6.2. Static fields, methods and properties* *6.3. Destructors* *6.4. Static constructor* *Literary sources: [1, 2, 5]*
	Chapter 2. Interfaces and collections
7.	*INTERFACES* *7.1. Concept of interface.* *7.2. Using interfaces.* *7.3. IComparable and IComparable<Type> interfaces* *7.4. The is and as operators* *Literary sources: [1, 2, 5]* *Additionally:* *Abstract data types. Modifiers abstract , new , sealed , static , readonly*
8.	*COLLECTIONS. CLASSES OF COLLECTIONS.* *8.1. C# collections. System.Collections namespace* *8.2. Iterators*

	8.3. Linear lists (List, Stack, Queue) *8.4. Namespaces: System.Collections, System.Collections.Generic, System.Collections.Specialized, and System.Collections.Concurrent.* *8.5. List<T> class* *Literary sources: [1, 2, 5]* *Additionally: Solving the system of linear equations by the Gaussian method.* *Straight line. Reverse move.*
	Chapter 3. Working with the .NET base class library
9.	*SYSTEM.IO NAMESPACE. FILE INPUT OUTPUT* *9.1. Basic classes of System.IO* *9.2. Basic methods of the Directory class* *9.3. Basic methods of the File class* *9.4. Read/write streams.* *9.5. Stream, FileStream, StreamWriter, StreamReader.* *9.6. FileMode and FileAccess enumerations* *9.7. Class System.Text.Encoding* *9.8. Examples of working with files* *9.9. The using operator.* *Literary sources: [1, 2, 5]* *Addition:* *Exception handling. The try…catch…finally statement. Exception generation.*
10.	*SERIALIZATION OF OBJECTS* *10.1. Concept of object serialization* *10.2. [Serializable] attribute* *10.3. Binary serialization BinaryFormatter from the System.Runtime.Serialization.Formatters.Binary namespace* *10.4. Serialization in XML - XmlSerializer of the System.Xml.Serialization namespace.* *Literary sources: [1, 2, 5]*
11.	*CREATION OF A WINDOWS FORMS PROJECT. APPLICATION CLASS* *11.1. System.Windows.Forms - namespace* *Literary sources: [1, 2, 5]*
12	*CREATION OF A WINDOWS FORMS PROJECT. APPLICATION CLASS* *1 2 . 1 . Creating a simple form in Windows Forms* *Literary sources: [1, 2, 5]*
1 3 .	*TYPES OF CONTROL ELEMENTS AND WORK WITH THEM* *1 3 .1. Functional classification of Windows Forms control elements* *Literary sources: [1, 2, 5]*
14	*TYPES OF CONTROL ELEMENTS AND WORK WITH THEM* *1 4 . 1 . Adding controls to Windows Forms* *Literary sources: [1, 2, 5]*
15 .	*GETTING TO KNOW THE GDI+ INTERFACE* *1 5 .1. Namespace System . Drawing , the main classes* *Literary sources: [1, 2, 5]*
16	*GETTING TO KNOW THE GDI+ INTERFACE* *1 6 . 1 . ARGB colors* *1 6 . 2 . Paint event* *Literary sources: [1, 2, 5]*
17 .	*CONSTRUCTION OF GRAPHS OF FUNCTIONS* *1 7 .1. Chart control element* *Literary sources: [1, 2, 5]*
18	*MKR*

Practical classes

No s/p	*Topics of practical classes*	*Number audio g one*
1	*Classes, fields. Methods. Method parameters.*	*2*
2	*Constructors, destructors and properties.*	*2*
3	*Collections and lists.*	*2*
4	*File input and output*	*2*
5	*Solving SLAR by the Gaussian method*	*2*
6	*Work with forms*	*2*
7	*Work with form elements*	*2*
8	*Drawing on forms*	*2*
9	*Graphing the function*	*2*
	IN GENERAL	*18*

Laboratory classes

No s/p	*The name of the laboratory work*	*Number audio hours*
1	*Classes* *Literary sources: [3]*	*3*
2	*Working with class fields. Access specifiers* *Literary sources: [3]*	*3*
3	*Class constructors* *Literary sources: [3]*	*3*
4	*Properties* *Literary sources: [3]*	*3*
5	*Collections and lists. Class List<T>* *Literary sources: [3]*	*4*
6	*File input and output Work with text files* *Literary sources: [3]*	*4*
7	*Creating a Windows Forms project. Application class* *Literary sources: [3]*	*4*
8	*Types of control elements and work with them* *Literary sources: [3]*	*4*
9	*Introduction to the GDI + interface* *Literary sources: [3]*	*4*
10	*Graphing the function* *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]*	*55*
2	*Preparation for MKR* *Literary sources: [4]*	*15*
3	*Preparation for the test*	*5*

	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 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 work by the student.*
- *policy of deadlines and rescheduling: late completion of laboratory work involves the accrual of penalty points. If the student did not pass or did not appear at 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 2"*
- *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.*
Calendar control *: is carried out twice a semester as a monitoring of the current state of fulfillment of the syllabus requirements.*
Semester control *: credit*
Conditions for admission to the semester control *: positive grades (>59 points) for each of the 10 laboratory works.*
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;*
- *execution of modular control work (MCR).*

Performance and protection of laboratory work	MKR	R
60	4 0	100

1. Laboratory works (10 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 10 passed laboratory works, the average arithmetic value is found ((L1+L2+…+L10)/10, where L1,L2,…,L10 are grades for the corresponding works), the obtained value is multiplied by a factor of 0.6, i.e. it is converted into points RSO from 36 to 60 points. If at least one laboratory work is not submitted, the grade for the laboratory work section is 0 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 0.4 , which gives from 0 to 40 points of RSO.

3. 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.

4. Total grade for work during the semester

It consists of the sum of RSO points for laboratory work and MKR. A maximum of 60+ 40 = 100, and incentive points. At the end of the semester, the semester control is conducted in the form of a hall and a classroom .

The form of semester control is credit

Only those students who have passed 10 laboratory works receive a passing grade.

Those students who passed 10 laboratory works, but did not score 60 points, perform tasks similar to the MCR according to the rules of the MCR, and this grade is taken into account instead of the MCR grade.

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)