MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY

Faculty of Architecture, Civil Engineering and Design
Computer Technologies of Airport Construction and Reconstruction Department

AGREED

Dean of the Faculty

_____ Viktor KARPOV

«_26_» _10_ _____ 2022

APPROVED

Vice Rector for Academics

_____ Anatolii POLUKHIN

«_31_» _10_ _____ 2022

Quality Management System

COURSE TRAINING PROGRAM
on
"Fundamentals of Programming"

Educational-Professional Program: «Industrial and Civil Engineering»

Field of study: 19   «Architecture and Construction»
Specialty: 192 «Building and Civil Engineering»

Form of training	Sem.	Total (hours/ ECTS credits))	Lec.	Prac.	Lab.	Self-study	Homeworks control works	CP/ TP	Form of control
Full-time	4	120/4	17	-	34	69	-	-	Graded Test 4th semester
Part-time	-	-	-	-	-	-	-	-	-

Index: ECB-5-192-1/22-3.5

QMS NAU CTP 10.01.04-01-2022

The Course Training Program on "Fundamentals of Programming" is developed on the basis of the Educational-Professional Program "Industrial and Civil Engineering", Bachelor Curriculum and Extended Curriculum № CB-5-192-1/21, № ECB-5-192-1/22 for training higher education seekers of the Bachelor degree of specialty 192 "Building and Civil Engineering" and corresponding normative documents.

Developed by:

Associate professor of the Computer Technologies
of Airport Construction and
Reconstruction Department   Oleksandr RODCHENKO

Discussed and approved by the Graduate Department for the Specialty 192 "Building and Civil Engineering" (Educational Professional Program "Industrial and Civil Engineering") – Computer Technologies of Airport Construction and Reconstruction Department, Minutes № 12 of "25" 10   2022.

Guarantor of the Educational and
Professional Program _____ Nataliia KOSTYRA

Head of the Department _____ Oleksandr LAPENKO

Vice Rector on International Collaboration and Education

_____ Iryna ZARUBINSKA

«24» 10   2022

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Planned term between revisions – 1 year
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CONTENTS

INTRODUCTION

The Course Training Program of the academic discipline "Fundamentals of Programming" was developed on the basis of the "Methodological recommendations for the development and execution of the syllabus of educational discipline of full-time and part-time forms of training", approved by rector's order No. 249/roz. of 29.04.2021 and relevant regulatory documents.

1. EXPLANATORY NOTE
1.1. Role, goal and objectives of the academic discipline.

The role of the discipline is the theoretical and practical basis of the set of knowledge and skills that form the profile of a specialist in computer technologies of building and civil engineering.

The goal of the academic discipline is the study of modern methods of information processing, skills of algorithmization and programming in the high-level algorithmic language C++, formation of knowledge and skills of creating software projects in the object-oriented programming environment of Microsoft Visual Studio, application of acquired skills in the learning process and future professional activities related to using personal computers in the field of construction and civil engineering.

The objectives of the academic discipline are the formation of knowledge and skills of the basics of software design; revealing the possibilities of using computers to solve applied problems in the field of building and civil engineering; studying the capabilities of the object-oriented Visual C++ programming environment for creating programs in the high-level C++ algorithmic language.

1.2. Educational outcomes of the academic discipline.
PLO6 – Apply modern information technologies to solve engineering and management problems of construction and civil engineering.
1.3. Competencies obtained through the academic discipline.
Ability to solve complex specialized building and civil engineering problems.
GC5 – Ability to use information and communication technologies.

1.4. Interdisciplinary links.
This discipline is based on knowledge of such disciplines as «Higher Mathematics», «Informatics (General Course)», and is the basis for studying the following disciplines: «BIM-management», «Constructions of Buildings and Structures», «Fundamentals of Computer Modeling», «BIM-technologies».

2. PROGRAM OF THE ACADEMIC DISCIPLINE.

2.1. Content of the academic discipline

The educational material of the discipline is structured on a modular basis and consists of one educational module, namely:

educational module 1 "Fundamentals of Programming", which is a logically complete, relatively independent, integral part of the curriculum, mastering of which involves a module test and results analysis.

2.2. Module structure and integrated requirements for each module
Module №1 «Fundamentals of Programming»
Integrated requirements for module 1:
To know:
- types of algorithms and the main ways of their construction;
- elements of the C++ algorithmic programming language (language alphabet, data types, rules for writing arithmetic expressions);
- features of creating software projects using Visual C++;
- operators of the C++ language;
- methods of development and implementation of linear, branching and loop algorithms and programs;
- modular principle of program development;
- means of programming basic algorithms for processing one-dimensional arrays;
- methods of working with text files.

Be able to:
- create linear, branched and loop algorithms for solving problems; build and describe block diagrams;

- develop programs with linear, branching and cyclical structures;

- create programs for calculating finite sums in loops, researching functions on a certain interval with calculating tables of values and constructing graphs;

- compose algorithms and programs in the C++ language for processing elements of vectors and matrices and execute them on a computer, namely: calculation of elements of a vector or matrix according to a formula, sorting of elements of arrays, search for minimum (maximum) values of elements of a vector or matrix, calculation of sums, of products and the number of elements of a vector or matrix by condition;

- develop software projects for text files processing.

Topic 1. The Context of Software Development.

Programs, data, models, languages. Binary notation of numbers. Principles of computer representation of numbers. Higher-level programming languages. Integrated development environment: Microsoft Visual Studio, Apple Xcode, Android Studio, Eclipse ADT. Development tools. Compilers. C++ programming. Windows Forms.

Topic 2. Programming of Linear Algorithms.

Types of algorithms. Sequential algorithms. Defining, declaring variables and data types. Constants. Mathematical operations in C++. Calculating in C++. Modifying a variable. Type conversion. Working with Windows Forms components: Button, Label, TextBox, RadioButton, DataGridView, TabControl, OpenFile, SaveFile.

Topic 3. Programming of Branching Algorithms.

Decision making statements. Relational operations and logical operations. Logical addition. Logical multiplication. Logical objection. The if-else statement. Conditional operator ?.

Topic 4. The switch Statement.

The syntax for the switch statement. Flow diagram of the switch statement. Structogram for the switch statement. Rules for the switch statement. Differences between switch and else-if chains. The break statement.

Topic 5. Loops Programming.

Loop types. Loop for. Cyclic processing of sequences of numbers. Cyclic factorial calculation. Loop control statements: continue, break. Nested loops. The while loop statement. The do-while loop statement.

Topic 6. Functions in C++.

Function purpose and definition. Standard built-in functions. Functions created by the user. Defining a function. Function declaration. Class. The name of the function. Result type (function type). Calling a function.

Topic 7. Fundamentals of File Input and Output.

File. The name of the file. Catalogue. Text files. Binary files. The System::IO namespace of the .NET Framework. Tools for processing text files in C++. File operations. File positions. The file stream classes. Functionality. Opening a file. File stream definition. Reading lines of a text file. Opening a text file. Change font and color. Saving changes made to a text file.

Topic 8. Single-Dimension Arrays.

Declaration of arrays. Single-dimension array. Declaration of a single-dimension array. Array name. Array index value. Array elements. Indexes of array elements. Calculation of the sum of array elements. Calculation of the number and sum of even elements of the array. Placement of array elements in reverse order. Determination of the minimum and maximum element of the array.

2.3. Thematic plan.

№	Topic	Academic hours							
		Full-time study				Part-time study			
		Total	Lectures	Lab. classes	Self-study	Total	Lectures	Lab. classes	Self-study
1	2	**3**	4	5	6	**7**	8	9	10
Module №1 «Fundamentals of Programming»									
		4 semester				**-**			
1.1	The Context of Software Development	9	2		7	-	-	-	-
1.2	Programming Languages	4	-	2	2	-	-	-	-
1.3	Integrated Development Environment	4	-	2	2	-	-	-	-
1.4	Programming of Linear Algorithms	9	2		7	-	-	-	-
1.5	Using Windows Forms	4	-	2	2	-	-	-	-
1.6	Working with Windows Forms Components	4	-	2	2	**-**			
						-	-	-	-
1.7	Programming of Branching Algorithms	4	2	-	2	-	-	-	-
1.8	Programming of Branching Algorithms in IDE Visual Studio	4	-	2	2	-	-	-	-
1.9	Conditional Operator ? in IDE Visual Studio	4	-	2	2	-	-	-	-
1.10	The switch Statement	4	2	-	2	-	-	-	-
1.11	SWITCH Statement in Visual C++	4	-	2	2	-	-	-	-
1.12	Creating a simple calculator	4	-	2	2	-	-	-	-
1.13	Loops Programming	5	2	-	3	-	-	-	-
1.14	Creating an engineering calculator	4	-	2	2	-	-	-	-
1.15	Loops Programming: Statement for	4	-	2	2	-	-	-	-
1.16	Functions in Visual C++	6	2	-	4	-	-	-	-
1.17	The while and do-while Loop Statements	4	-	2	2	-	-	-	-
1.18	Functions in IDE Visual Studio	4	-	2	2	-	-	-	-
1.19	Fundamentals of File Input and Output	6	2	-	4	-	-	-	-
1.20	Ways to pass parameters to a function	4	-	2	2	-	-	-	-
1.21	Working with text files in IDE Visual Studio	4	-	2	2	-	-	-	-
1.22	Single-Dimension Arrays	6	2	-	4	-	-	-	-
1.23	Single-Dimension Arrays in IDE Visual Studio	4	-	2	2	-	-	-	-
1.24	Calculation of the number of even elements of the array	4	-	2	2	-	-	-	-
1.25	Determination of the maximum element of the array	4	-	2	2	-	-	-	-
1.26	Module Test №1	4	2	-	2	-	-	-	-
	Total for Module №1	120	17	34	69	-	-	-	-
	Total For Academic Discipline	120	17	34	69	-	-	-	-

3. TRAINING MATERIALS FOR THE DISCIPLINE

3.1. Teaching methods
When studying the discipline, the following teaching methods are used:
- explanatory-illustrative method;
- method of problem statement;
- reproductive method.

The implementation of these methods is carried out during lectures, demonstrations, independent work, work with educational literature, tasks in Microsoft Visual Studio.

3.2. Recommended literature
Basic literature
3.2.1. Кривцова О.П. Програмування мовою С++. Технологія візуального програмування : навч. посіб. – Полтава : ПНПУ імені В.Г. Короленка, 2020. – 144 с.

3.2.2. Проектування програмних доданків: Частина I. Комп'ютерні практикуми: навч. посіб. для студ. спеціальності 151 – «Автоматизація та комп'ютерно-інтегровані технології» / КПІ ім. Ігоря Сікорського; уклад.: В. I. Бендюг, Б. М. Комариста. – Київ: КПІ ім. Ігоря Сікорського, 2018. – 285 с.

Additional literature
3.2.3. Прикладне програмне забезпечення – 3. Проектування програмних додатків: методичні рекомендації до виконання комп'ютерних практикумів для студентів напряму підготовки 151 – «Автоматизація та комп'ютерно-інтегровані технології» / [уклад. Бендюг В. I., Комариста Б. М.]. – К: 2016. – 255 с.

3.2.4. Сучасні технології програмування: Частина I. Практичні роботи [Електронний ресурс]: навч. посіб. для студ. спеціальності 151 – «Автоматизація та комп'ютерно-інтегровані технології» / КПІ ім. Ігоря Сікорського; уклад.: В. I. Бендюг, Б. М. Комариста. – Київ: КПІ ім. Ігоря Сікорського, 2019. – 269 с.

3.3. Internet information resources
3.3.1. http://er.nau.edu.ua/handle/NAU/24905

3.3.2. http://www.lib.nau.edu.ua/main/

3.3.3. Методичні розробки кафедри (в електронному вигляді).

3.3.4. https://visualstudio.microsoft.com

3.3.5. https://visualstudio.microsoft.com/thank-you-downloading-visual-studio/?sku=Community&rel=16

3.3.6.https://docs.microsoft.com/ru-ru/dotnet/desktop/winforms/?view=netdesktop-5.0

3.3.7. https://docs.microsoft.com/ru-ru/windows/apps/project-reunion/get-started-with-project-reunion

3.3.8. https://docs.microsoft.com/ru-ru/windows/apps/project-reunion/

4. RATING SYSTEM OF KNOWLEDGE AND SKILLS ASSESSMENT

4.1. Evaluation of certain types of work done by students of the points made in accordance with Tables.4.1.

Table 4.1

Kind of Academic Activities	Maximum Grade	
	Full-time study	Part-time study
	4 semester	-
Module №1 «Fundamentals of Programming»		
Laboratory classes	70	-
For carrying out a module test a student must receive not less than	*42*	-
Carrying out a module test №1	30	–
Total for module 1	**100**	**-**
Total for academic discipline	**100**	

A Semester Grade is determined (in points and in the National Scale) as a result of performing all kinds of educational work during the semester.

4.2. A student is considered to have passed the module if both his/her Current Module Grade and Module Test Grade are positive.

4.3. The Semester Module Grade is calculated as the sum of the Total Module Grades.

4.4. The Semester Module Grade and the Graded Test together make up a Total Semester Grade which is calculated according to the National Scale and the ECTS Scale.

4.5. The Total Semester Grade in points, the National Scale and the ECTS Scale is written into a student's record book, for example: ***92/Ex/A, 87/Good/B, 79/Good/C, 68/Sat/D, 65/Sat./E***, etc.

4.6. The Total Semester Grade of the subject is determined as the arithmetic average grade of the total semester grades in points (for the fourth semester for this subject) with its further transfer into the National Scale and ECTS Scale. The indicated Total Semester Grade of the subject is entered in the Diploma Supplement.

(Ф 03.02 – 01)

АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки

(Ф 03.02 – 02)

АРКУШ ОЗНАЙОМЛЕННЯ З ДОКУМЕНТОМ

№ пор.	Прізвище ім'я по-батькові	Підпис ознайомленої особи	Дата ознайом-лення	Примітки

(Ф 03.02 – 04)

АРКУШ РЕЄСТРАЦІЇ РЕВІЗІЇ

№ пор.	Прізвище ім'я по-батькові	Дата ревізії	Підпис	Висновок щодо адекватності

(Ф 03.02 – 03)

АРКУШ ОБЛІКУ ЗМІН

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла зміну	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульо-ваного			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				

Syllabus of the academic discipline
«FUNDAMENTALS OF PROGRAMMING»
Educational and professional program:
«Industrial and Civil Engineering»,
Field of study: 19 «Architecture and Construction»
Specialty: 192 «Building and Civil Engineering»

Level of higher education	First (Bachelor)
Discipline status	Academic discipline of the selective component
Course	2
Semester	4
ECTS credits / hours	4,0 / 120
Language of training	English
What will be studied (subject of study)	Creation of software projects in the object-oriented Visual Studio programming environment in the high-level C++ algorithmic language.
Why is it interesting / necessary to study (goal)	The goal of the academic discipline is the study of modern methods of information processing, skills of algorithmization and programming in the high-level algorithmic language C++, formation of knowledge and skills of creating software projects in the object-oriented programming environment of Microsoft Visual Studio, application of acquired skills in the learning process and future professional activities related to using personal computers in the field of construction and civil engineering.
Why can you learn (learning outcomes)	Ability to create Windows Forms applications.
How to use the acquired knowledge and skills (competencies)	The acquired knowledge and skills can be used during the completion of the bachelor thesis.
Educational logistics	**Content of the discipline:** integrated development environment. Programming in C++ language. Using Windows Forms. Types of algorithms. Linear algorithms. C++ data types. Constants in C++. Mathematical functions in C++. Rules for writing arithmetic expressions. Assignment operators in C++. Summarizing types in C++. Working with Windows Forms components. Branching algorithms. Conditional statement if. Conditional operation "?". Syntax of conditional operation "?". The switch statement. Loop operator with the for statement. The syntax of the for statement. A loop statement with a precondition. A loop statement with a postcondition. Organization of functions in C++. Work with text files. Text files. Binary files. The System::IO namespace of the .NET Framework. One-dimensional arrays. **Classroom sessions:** lectures, laboratory classes. **Teaching methods:** discussion, online. **Form of training:** full-part
Prerequisites	Knowledge of infromatics.
Porekvizyty	The acquired knowledge and skills can be used during the completion of the bachelor thesis.

Information support from the repository and fund of NTL NAU	1. Основи програмування: навчальний посібник / МОН України / Козак Л.І., Костюк І.В., Стасевич С.П. – Л. : Новий Світ - 2000, 2011. – 328 с. 2. Нойес Брайан Привязка данных в Windows Forms. Программирование клиентских приложений обработки данных на платформе .NET: пер. с англ. – Москва: Бином, 2009. – 632 с. 3. Щупак Ю.А. Win32 API. Эффективная разработка приложений. – Санкт-Петербург: Питер, 2007. – 572 с.
Location and logistics	Computer classroom, projection equipment
Semester control, examination methods	tests, module test
Department	Computer technologies of airport construction and reconstruction
Faculty	Archictecture, civil engineering and design
Professor	**RODCHENKO OLEKSANDR** **Position:** Associate Professor **Scientific degree:** Candidate of Sciences **Academic title:** Associate Professor **Profile:** https://rodchenko-edu.wixsite.com/about **tel.:** 406-74-25 **E-mail:** oleksandr.rodchenko@npp.nau.edu.ua **Room:** 5.510
Originality of academic discipline	Author's course
Link to discipline	