

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

Department of Descriptive Geometry, Computer Graphics and Design



«**CONFIRMED**»

Dean of the Faculty
Construction and design

Zinoviy RUZHYLO

"16" May 2023

«**APPROVED**»

at the meeting of the Department of Descriptive Geometry

Computer graphics and design

Protocol No.10 dated 05/13/2023

Head of the Department

Serhii PYLYPAKA

«**REVIEWED**»

Program Coordinator

192 «Construction and civil engineering»

Yevhen DMYTRENKO

PROGRAM OF THE COURSE

COMPUTERS AND COMPUTER TECHNOLOGIES

Educational program – "Construction and Civil Engineering"

Specialty - 192 "Construction and civil engineering"

Faculty of Construction and Design

Developer: Prof. Doctor of Technical Sciences - **Viktor NESVIDOMIN**

Kyiv – 2023

1. Description of the course

Computers and computer technologies are a scientific discipline that studies the principles of construction and functioning of computers, the organization of computing processes on personal computers, their algorithmization, PC software, as well as the effective use of modern information and communication technologies in construction activities. The main focus is on gaining skills in working with CAD technologies in computer graphics and CAS technologies in computer mathematics.

| | | |
|--|--|-------------------------|
| Branch of knowledge, direction of training, specialty, educational qualification level | | |
| Educational degree | Bachelor | |
| Specialization | 192 - Construction and Civil Engineering | |
| Educational program | освітньо-професійна | |
| Characteristics of the course | | |
| Type | Compulsory/elective | |
| Total number of hours | 210 | |
| Number of ECTS credits | 7 | |
| Number of content modules | 4 | |
| Course project (work) (if applicable) | - | |
| Form of assessment | екзамен | |
| Indicators of the course for full-time and part-time forms of study | | |
| | Full-time form of study | Part-time form of study |
| Course (year of study) | 1 | 1 |
| Semester | 1, 2 | 1, 2 |
| Lecture classes, hr | 30 / 15 | 30 / 15 |
| Practical, seminar classes, hr | 30 / 15 | 30 / 15 |
| Laboratory classes, hr | 120 | 120 |
| Self-study | - | - |
| Individual assignments, hr | 4 / 2 | 4 / 2 |

2. The purpose and objectives of the course

The purpose of discipline is to obtain students theoretical knowledge of the basics of computer technology, to acquire practical skills in working on personal computers using existing CAS and CAD technologies on a PC in solving engineering problems in construction.

The study of the discipline will allow you to know:

- elements of programming in a programming language, to form and solve engineering problems using modern computer mathematics systems;
- work on a PC with modern computer graphics systems.

As a result of studying the discipline should be able to:

- decompose the task and implement program codes for their recording on the PC, implement numerical methods;

- use the capabilities of computer graphics systems in the formation of 2 D and 3 D-models of building structures.

Acquisition of competencies:

- integral competence (IC):

IR - Ability to solve complex specialized problems of construction and civil engineering in the learning process, which involves the use of a set of theories and methods for determining strength, stability, deformativity, modeling, strengthening of building structures; further safe operation, reconstruction, erection and installation of buildings and engineering structures; application of computer-aided design systems in the field of construction.

- General competencies (GC):

GC1 – Ability to abstract thinking, analysis and synthesis.

GC2 – Knowledge and understanding of the subject area, understanding of the professional activities of the construction industry.

GC4 – Ability to communicate in a foreign language.

GC5 – Ability to use information and communication technologies.

GC6 – Ability to apply knowledge in practical situations.

GC7 – Ability to evaluate and ensure the quality of work performed.

- Professional (special) competencies (FC):

SK4 – Ability to select and use appropriate equipment, materials, tools and methods for the design and implementation of technological processes of construction production.

SK5 – Ability to apply computerized design systems and specialized application software to solve engineering problems of construction and civil engineering.

SK6 – Ability to engineering activities in the field of construction, preparation and use of technical documentation.

SK7 – Ability to take responsibility for the development and decision-making of architecture and construction in unpredictable work contexts.

SK11 – Possess methods of design, modeling and construction using computer-aided design and calculation of building structures of buildings and engineering structures of industrial, agro-industrial, transport and civil objects.

Program learning outcomes (PRN):

PPH1 – Demonstrate knowledge of fundamental and general engineering disciplines at the level necessary to understand the processes of design, construction, operation and reconstruction of construction objects.

PPH3 – Present the results of their own work and argue their position on professional issues to specialists

PPH6 – Apply modern information technologies to solve engineering and management problems of construction and civil engineering.

PPH7 – Collect, interpret and apply data, including through the search, processing and analysis of information from various sources.

3. Program and Structure of the discipline

| Titles of content modules and topics | Number of hours | | | | | | | | | | | |
|---|-----------------|--------------|----|-----|-----|------|---------------------|--------------|----|-----|-----|------|
| | Full-time form | | | | | | Correspondence form | | | | | |
| | full | у тому числі | | | | | full | у тому числі | | | | |
| | | л. | пр | лаб | інд | с.р. | | л. | пр | лаб | інд | с.р. |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1- semester | | | | | | | | | | | | |
| Content module 1. Basics of algorithmization | | | | | | | | | | | | |
| Topic 1. Hardware | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 2. Software | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 3. Basics of algorithmization | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 4. Programming elements | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 5. Operators | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 6. Functions and procedures | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 7. Graphics programming | 6 | 2 | 2 | | | 4 | | | | | | |
| Total by content module 2 | 42 | 14 | 14 | | | 28 | | 8 | 8 | | | 8 |
| Content module 2. Computer mathematics in MapleSoft environment | | | | | | | | | | | | |
| Topic 8. Vectors in Maple | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 9. Matrices in Maple | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 10. Interpolation | 6 | 2 | 2 | | | 4 | | 2 | 2 | | | 2 |
| Topic 11. Approximation | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 12. Solutions of equations | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 13. Diff. and integration | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 14. Optimization | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 15. Credit work | 6 | 2 | 2 | | | 4 | | | | | | |
| Total by content module 2 | 48 | 16 | 16 | | | 32 | | 4 | 4 | | | 4 |
| Total hours | 90 | 30 | 30 | | | 60 | | 12 | 12 | | | 12 |
| 2-semester | | | | | | | | | | | | |
| Content module 1. Engineering graphics in AutoDesk Inventor | | | | | | | | | | | | |
| Topic 1. Types of graph | 6 | 2 | 2 | | | 4 | | 2 | 2 | 2 | | 2 |
| Topic 2. Systems comp. Graphics | 6 | | 2 | | | 4 | | 2 | 2 | 2 | | 2 |
| Topic 3. Two-dimensional graphics | 6 | 2 | 2 | | | 4 | | 2 | 2 | 2 | | 2 |
| Topic 4. Three-dimensional graphics. Elements of parts | 6 | | 2 | | | 4 | | | | | | |
| Topic 5: Standard Details. Materials | 6 | 2 | 2 | | | 4 | | 2 | 2 | 2 | | 2 |
| Topic 6. Assembly products. Specification | 6 | | 2 | | | 4 | | | | | | |
| Topic 7. Registration of graphic documentation | 9 | 2 | 2 | | | 4 | | | | | | |
| Total by content module 2 | 45 | 8 | 14 | | | 28 | | 8 | 8 | 8 | | 8 |
| Content module 2. Construction graphics in the SolidWorks environment | | | | | | | | | | | | |
| Topic 8. Detailing | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 9. 3D modeling | 6 | | 2 | | | 4 | | 2 | 2 | 2 | | 2 |

| | | | | | | | | | | | | |
|---------------------------------|----|----|----|--|--|----|--|----|----|----|--|----|
| Topic 10. Connection | 6 | 2 | 2 | | | 4 | | 2 | 2 | 2 | | 2 |
| Topic 11. Associative drawings | 6 | | 2 | | | 4 | | | | | | |
| Topic 12. Assembly drawings | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 13. Product presentations | 6 | | 2 | | | 4 | | | | | | |
| Topic 14. Kinematic analyze | 6 | 2 | 2 | | | 4 | | | | | | |
| Topic 15. Exam | 6 | 1 | 1 | | | 2 | | | | | | |
| Total by content module 2 | 45 | 8 | 14 | | | 4 | | 4 | 4 | 4 | | 4 |
| Total hours | 90 | 15 | 30 | | | 30 | | 12 | 12 | 12 | | 12 |

4. Topics of practical classes

| № | Name | Hr. |
|-------------|--|-----|
| Semester 1 | | |
| 1. | Information technology. Principles of PC operation. | 2 |
| 2. | PC device specifications | 2 |
| 3. | Software installation. Utilities | 2 |
| 4. | Arithmetic calculations in MathCAD and Maple systems | 2 |
| 5. | Programming linear algorithms in the Maple environment | 2 |
| 6. | Programming of branched and cyclic algorithms | 2 |
| 7. | Construction of curved lines and surfaces. Animation | 2 |
| 8. | Vector operations | 2 |
| 9. | Matrix operations. Systems of linear equations | 2 |
| 10. | Data processing. Interpolation | 2 |
| 11. | Approximation. Extrapolation | 2 |
| 12. | Nonlinear single-variable equations | 2 |
| 13. | Differentiation and integration. Approximate methods | 2 |
| 14. | Optimization methods | 2 |
| 15. | Credit work | 2 |
| Total hours | | 30 |
| Semester 2 | | |
| 1. | Types of graph. Vector and pixel graphics | 2 |
| 2. | Vector graphics systems. AutoDesk graphics packages | 2 |
| 3. | Installing AutoDesk Inventor. Interface | 2 |
| 4. | Creating models of parts | 2 |
| 5. | Creating pipe connection models | 2 |
| 6. | Associative drawings of parts | 2 |
| 7. | Associative drawings of assembly units | 2 |
| 8. | Details. Computer graphics in the SolidWorks environment | 2 |
| 9. | Operations of modeling elements of parts. Rifled | 2 |
| 10. | Complex parts modeling operations | 2 |
| 11. | Assembly operations. Types of compounds | 2 |
| 12. | Creation of design documentation | 2 |
| 13. | Create presentations. Work with color, scene | 2 |
| 14. | Kinematic analysis | 2 |

| | | |
|-----------------------|------|----|
| 15. | Exam | 2 |
| Together for semester | | 30 |
| Together | | 60 |

5. Independent work under the guidance of a teacher

| No | Name | Hr. |
|----------------------|--|-----|
| Semester 1 | | |
| 1. | Hardware and software | 10 |
| 2. | Linear, branched and cyclic algorithms | 10 |
| 3. | Curved lines and surfaces. Animation | 10 |
| 4. | Vectors and matrices. Systems of linear equations | 10 |
| 5. | Interpolation and approximation | 10 |
| 6. | Nonlinear single-variable equations | 10 |
| Total for 1 semester | | 60 |
| Semester 2 | | |
| 7. | Creation of design documentation for pipe connection | 30 |
| 8. | Construction machine detailing | 30 |
| In just a semester | | 60 |
| Together | | 120 |

6. Control questions, test kits to determine the level of assimilation of knowledge by students

1. What is an operating system? Give examples of operating systems.
2. What is the difference between hardware and software?
3. Give units of measurement for information.
4. What is computer architecture?
5. What is an algorithm? What are the main characteristics of algorithms?
6. What are the main types of software and what is their role?
7. What are the basic principles of the Internet? Explain TCP/IP.
8. What are logical functions and how are they related to Boolean algebra?
9. What is the difference between logical AND, logical OR, and logical NOT?
10. How to create a variable and assign a value to it in MapleSoft?
11. How to display the result in MapleSoft?
12. How to create if-else conditional statement in MapleSoft?
13. How to create a for loop in MapleSoft and how is the iteration performed?
14. What are the basic methods of working with arrays (vectors and matrices) in MapleSoft?
15. What does the abbreviation CAD mean and what is the purpose in the construction industry?
16. What methods are used to create 3D models of building structures in CAD systems?
17. What is computer graphics?
18. What are the types of computer graphics and what is the difference between them?
19. What is a coordinate system and how is it used in graphics?

20. What is three-dimensional graphics and what are the main methods used to reproduce it?
21. What are textures and how are they used to improve realism?
22. How does animation work in computer graphics?
23. What are the main interface elements of Autodesk Inventor?
24. What are the main document types that can be created by Autodesk Inventor?
25. What tools are used to create solid-state models?
26. What relationships are there for assembly in Autodesk Inventor?
27. What tools are used to create and edit drawings?
28. How to import and export files in different formats (e.g. STEP, IGES, STL) in Autodesk Inventor?
29. How to create a sheet metal model in SolidWorks?
30. How to use SolidWorks Toolbox to select standard parts?
31. How to import and export files in different formats (e.g. DWG, DXF) in SolidWorks to exchange data with other CAD systems?

7. Teaching methods

Training is conducted by means of information and communication technologies in education. A certified e-learning course on the ELearn platform "Computers and Computer Technologies" is used.

<https://elearn.nubip.edu.ua/course/view.php?id=2155>

<https://elearn.nubip.edu.ua/course/view.php?id=2754>

Classes are held in the following sequence:

- presentation of new material (lecture, classroom lesson);
- consolidation of new material (independent work outside the audience, using literature and an electronic resource);
- consolidation of acquired skills (classroom lesson);
- improvement of skills acquired in previous classes (performance of work after school hours with the processing of lecture material, use of literature, Internet resource.)

Checking the level of assimilation of the material and the ability to independently perform work is carried out by performing tests on a separate topic. A test paper that can be either a test task or a practical task that should be done in a limited time in a laboratory lesson.

8. Forms of control

To consolidate the material studied, students perform individual graphic works. Works are evaluated by completeness and quality of performance, as well as deadlines. The work can be evaluated from 60 to 100 points (percent). The work completed by less than 60 points is returned to the student for revision and will be counted only after its completion. To check the level of assimilation of theoretical material and the ability to independently perform work, control surveys (tests) and tests are conducted, respectively. Tests are performed for a limited time during the classroom lesson. The content of the test is a narrow practical problem, the solution of which was studied

during a certain period of study. The arithmetic mean determines the number of points for the module, takes into account all graphic works, tests and tests performed during the module.

The distribution of points that students receive. Assessment of student's knowledge takes place on a 100-point scale and is translated into national assessments in accordance with the current version of the "Regulations on examinations and tests at NUBiP of Ukraine".

| Student rating, points | National rating | |
|------------------------|-----------------|--------------|
| | Examinations | Credits |
| 90-100 | Perfectly | Enrolled |
| 74-89 | Good | |
| 60-73 | Satisfactory | |
| 0-59 | Disappointing | Not credited |

To determine the rating of a student (listener) in mastering the discipline RDIS (up to 100 points), the received rating in certification (up to 30 points) is added to the rating of the student (listener) in academic work R_{HP} (up to 70 points): $R_{DIS} = R_{HP} + R_{AT}$.

9. Educational and methodological support

List of visual and other teaching aids, teaching materials.

| № | Name | Quantity |
|----|---|----------|
| 1. | Slides (electronic form) for the lecture course | 1 прим. |
| 2. | Tutorial | E-Learn |

Base

- <https://www.maplesoft.com>
- <https://www.autodesk.com/>
- <https://www.solidworks.com/>
- Інформатика та комп'ютерна техніка. / Ткач Т.Б. – Одеса, 2019. -100 с.
- Чисельні методи: Навчальний посібник. / Волонтир Л.О, Зелінська О.В., Потапова Н.А., Чіков І.А. – Вінниця: ВНАУ, 2020 – 322 с.
- Алгоритми та методи обчислень [Електронний ресурс]: навч. посіб. / М. А. Новотарський. -- Київ : КПІ ім. Ігоря Сікорського, 2019. – 407 с.
- Числові методи: навч. посібник / О.І. Ярошенко, М.В. Григорків. – Чернівці : Чернівецький нац. ун-т, 2018. – 172 с.
- Інформаційні технології: навч. посіб. / Р.О.Тарасенко, С.М.Гаріна, Т.П.Рабоча; К.: ТОВ "Алефа", 2011. - 332 с.
- Gindis, E. J., Kaebisch, R. C. (2020). Up and Running with AutoCAD 2021: 2D and 3D Drawing, Design and Modeling. Нідерланди: Elsevier Science.

Secondary

- Ситник В.Ф. Основи інформаційних систем: Навч. Посібник.- Вид. 2-ге, перероб. І доп. / За ред.В.Ф. Ситника/-К.:КНЕУ,2001 .-420 с.
- Інформаційні системи та технології: навч. посіб. для студентів / О. В. Грицунов; Харк. нац. акад. міськ. госп-ва. – Х.: ХНАМГ, 2010. – 222 с.

12. Нелюбов В. О., Куруца О. С. Основи інформатики. Microsoft Excel 2016: навчальний посібник. Ужгород: ДВНЗ «УжНУ», 2018. - 58 с.
13. Комп'ютерна графіка : навчальний посібник : в 2-х кн.1. для студентів спеціальності 151 «Автоматизація та комп'ютерноінтегровані технології» / Укладачі : Тотосько О.В., Микитишин А.Г., Стухляк П.Д. – Тернопіль : Тернопільський національний технічний університет імені Івана Пулюя, 2017 – 304 с.
14. Ляшенко Б.М. , Кривонос О.М., Вакалюк Т.А. Методи обчислень: навчально-методичний посібник для студентів фізико-математичного факультету. – Житомир: Вид-во ЖДУ, 2014. – 228 с.

Recommended regulations

15. Стандарт вищої освіти за спеціальністю 122 «Комп'ютерні науки» для першого (бакалаврського) рівня вищої освіти. URL: <https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/2019/07/12/122-kompyut.nauk.bakalavr-1.pdf>.
16. Нові інформаційні технології, Електронний посібник, Режим доступу <http://www.eduforme.org/mod/page/view.php?id=13>
17. Гніденко І.Г., Соколовська С.А. Інформатика. Сайт Google Книги / 10.06.2007. <http://www.books.google.com.ua/books?isbn=5765429521>