

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

« 28 » 10 2022

APPROVED

Vice Rector for Academics


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« 01 » 11

2022



Quality Management System

COURSE TRAINING PROGRAM
on
"Introduction to Computer-Aided Design"

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	3	120/4	17	-	34	69	-	-	Graded Test 3 ^d semester
Part-time	-	-	-	-	-	-	-	-	-

Index: CB-5-192-1/21-3.1


QMS NAU CTP 10.01.04-01-2022



The Course Training Program on “Introduction to Computer-Aided Design” 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-5-192-1/21 for training higher education seekers of the Bachelor degree of specialty 192 "Building and Civil Engineering" and corresponding normative documents.

Developed by:

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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.

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«29» 10 2022

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INTRODUCTION

The Course Training Program of the academic discipline "Introduction to Computer-Aided Design" 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 building and civil engineering.

The goal of the academic discipline is the study of fundamentals of computer-aided design in AutoCAD.

The objectives of the academic discipline is the study of modern graphic systems trends; standards in the field of graphic systems development; 2D and 3D modeling; fundamentals of geometric modeling; methods of creating photorealistic images; classification of modern graphic systems.

1.2. Educational outcomes of the academic discipline.

LO06. Apply modern information technologies to solve engineering and management problems of building and civil engineering.

1.3. Competencies obtained through the academic discipline.

Ability to solve complex specialized building and civil engineering problems.

GC05. Ability to use computerized design systems and specialized application software to solve engineering problems in building and civil engineering.


1.4. Interdisciplinary links.

This discipline is based on knowledge of such disciplines as «Informatics (General Course)», «Engineering Graphics», and is the basis for studying the following disciplines: «Constructions of Buildings and Structures», «Fundamentals of Computer Modeling», «Reinforced concrete and stone structures».

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:

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educational module 1 "Introduction to Computer-Aided Design", 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 «Introduction to Computer-Aided Design»

Integrated requirements for module 1:

To know:

- technical capabilities of modern PCs;
- characteristics of modern technical, mathematical and software components of computer graphics;
- principles of interactive formation of graphic images of flat and three-dimensional objects using AutoCAD system tools.

Be able to:

- create and modify vector graphic images;
- start of work in AutoCAD;
- set up drawing parameters;
- set limits, scale and drawing modes;
- create graphic objects in AutoCAD;
- draw up and edit drawings in AutoCAD;
- create 2D and 3D models in AutoCAD;
- use AutoCAD tools to create 2D models according to the given conditions;
- use AutoCAD tools to create 3D models according to the given conditions.

Topic 1. Computer-Aided Design (CAD).

The main tasks of CAD. The general structure of CAD. CAD systems and subsystems. Principles of integration of subsystems and interaction in project procedures.


Linguistic support of CAD. CAD information support. CAD software. Purpose, capabilities, fields of AutoCAD use. Basic commands, parameters, system characteristics. The concept of layer-by-layer drawing creation. Simple primitives, shaping and editing. Characteristics of primitives.

Topic 2. Hardware for CAD.

Considered the main devices for input and output of graphic images and their main characteristics, monitors, video adapters, printers, plotters, scanners, digitizers, graphic tablets, mice, joysticks, etc.

Topic 3. The Basic Color Models.

The issues of "color" are considered, the history of studying the concept of "color", the main color models such as RGB, SMY and other color models are given.

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Topic 4. Raster Graphics Algorithms.

Raster. Raster characteristics. Rasterization of a straight line segment. Pixel. Digital differential analyzer. Circle construction algorithm. Smoothing algorithm.

Topic 5. Iteration Methods of Polygon Analysis.

Polygon. Types of polygons. Triangulation. Triangulation problems. Triangulation of convex polygons. Triangulation of a non-convex polygon. Delaunay triangulation.

Topic 6. Polygonal Assignment of Three-Dimensional Shapes.

Basic terms and concepts. Constituent elements of a polygonal grid. Polygonal grid topology. A polygon as the main part of a polygonal grid. Primitives with predefined polygon meshes. Bezier surface. Bezier spline. Bezier triangle.

Topic 7. 3D Scene Creation.


Painter algorithm. Z-buffer algorithm. Concept of texture in computer graphics. Concept of "Shadow" in Computer Graphics. Ray Tracing in Computer Graphics. Concept of "Fog" in Computer Graphics. Stereoscopic Image in Computer Graphics.

Topic 8. Fractal Graphics.

The concept of "fractal". The history of the emergence of fractal graphics, the concept of dimension and its calculation. Geometric fractals, algebraic fractals, system of iterated functions, stochastic fractals, fractals and chaos.

2.3. Thematic plan.

№	Topic	Academic hours							
		Full-time study				Part-time study			
		Total	Lectures	Lab. classes	Self-study	Total	Lectures	Lab. classes	Practicals
1	2	3	4	5	6	7	8	9	10
Module №1 «Introduction to Computer-Aided Design»									
1.1	Computer-Aided Design (CAD)	3 semester				-			
		9	2		7	-	-	-	-
1.2	AutoCAD user interface. AutoCAD settings. Object properties and layers. Ray. Lines creation. Using of Coordinates and Coordinate Systems.	4	-	2	2	-	-	-	-
1.3	Graphical Elements in AutoCAD	4	-	2	2	-	-	-	-
1.4	Hardware for CAD	9	2		7	-	-	-	-
1.5	Polyline in AutoCAD.	4	-	2	2	-	-	-	-
1.6	Modify tab in AutoCAD.	4	-	2	2	-			
						-	-	-	-
1.7	The Basic Colour Models.		2	-	2	-	-	-	-
1.8	Hatch in AutoCAD.	4	-	2	2	-	-	-	-
1.9	Creating and Editing Layout	4	-	2	2	-	-	-	-

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1	2	3	4	5	6	7	8	9	10
1.10	Raster Graphics Algorithms		2	-	2	-	-	-	-
1.11	Working with text. Adding and editing a schedule table in AutoCAD.	4	-	2	2	-	-	-	-
1.12	Dimensions in AutoCAD.	4	-	2	2	-	-	-	-
1.13	Iteration Methods of Polygon Analysis	5	2	-	3	-	-	-	-
1.14	Blocks and External References in AutoCAD.	4	-	2	2	-	-	-	-
1.15	Fundamentals of 3D modeling.	4	-	2	2	-	-	-	-
1.16	Polygonal Assignment of Three-Dimensional Shapes	6	2	-	4	-	-	-	-
1.17	Surfaces in AutoCAD.	4	-	2	2	-	-	-	-
1.18	Kuhn surface. Flat surface. Surface primitives.	4	-	2	2	-	-	-	-
1.19	3D scene creation.	6	2	-	4	-	-	-	-
1.20	Extrude tool in AutoCAD	4		2	2	-	-	-	-
1.21	Revolved solids in AutoCAD.	4		2	2	-	-	-	-
1.22	Fractal Graphics	6	2	-	4	-	-	-	-
1.23	Bases of 3D solid editing.	4	-	2	2	-	-	-	-
1.24	Working with Materials in AutoCAD.	4	-	2	2	-	-	-	-
1.25	Creating lights and rendering.	4	-	2	2	-	-	-	-
1.26	Module Test №1	3	1	-	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 AutoCAD.


3.2. Recommended literature

Basic literature

3.2.1. AutoCAD. Learn about AutoCAD. An Introduction to AutoCAD for Beginners, 2020, 92 p.

3.2.2. Бойко А. П. Комп'ютерне моделювання в середовищі AUTOCAD. Частина 1. Геометричне та проєкційне креслення : навч. посіб. / А. П. Бойко. – Миколаїв : Вид-во ЧНУ ім. Петра Могили, 2017. – 116 с.

3.2.3. Комп'ютерна графіка (лабораторні роботи): навч. посіб. для студ. спеціальності 151 «Автоматизація та комп'ютерно-інтегровані технології» / Укладач: Т. Г. Баган; КПІ ім. Ігоря Сікорського. – Київ : КПІ ім. Ігоря Сікорського, 2020. – 82 с.

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3.2.4. Саєнко С. Ю. Основи САПР / С. Ю. Саєнко, І. В. Нечипоренко – Х. : ХДУХТ, 2017. – 120 с.

Additional literature

3.2.5. для студ. спеціальності 151 «Автоматизація та комп'ютерно-інтегровані технології», спеціалізації «Комп'ютерно- інтегровані технології та системи у приладобудуванні» / КПІ ім. Ігоря О.О. Подолян, М.М. Гладський. – Київ: КПІ ім. Ігоря Сікорського, 2021. – 97 с.

3.2.6. Системи автоматизованого проектування в будівництві : навчальний посібник / [А. С. Моргун, В. М. Андрухов, М. М. Сорока, І. М. Меть.] – Вінниця : ВНТУ, 2015. – 129 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).

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
	3 semester	-
Module №1 «Introduction to Computer-Aided Design»		
Laboratory classes	70	-
<i>For carrying out a module test a student must receive not less than</i>	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.

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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 ознайомлення	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	Анульованого			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН


	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				



Syllabus of the academic discipline
«INTRODUCTION TO COMPUTER-AIDED DESIGN»
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	3
ECTS credits / hours	4,0 / 120
Language of training	English
What will be studied (subject of study)	Drawing creation in AutoCAD.
Why is it interesting / necessary to study (goal)	The goal of the academic discipline is the study of fundamentals of computer-aided design in AutoCAD.
Why can you learn (learning outcomes)	Ability to create drawings of building structures in AutoCAD.
How to use the acquired knowledge and skills (competencies)	The acquired knowledge and skills are the basis for studying the following disciplines: «Constructions of Buildings and Structures», «Fundamentals of Computer Modeling», «Reinforced Concrete and Stone Structures».
Educational logistics	<p>Content of the discipline: Computer-aided design (CAD). AutoCAD user interface. AutoCAD settings. Properties of objects. Layers. Lines. Rectangle and polygon. Circle. Arc. Spline. Ellipse. Elliptical arc. Polyline. Point. Ring. Multiline. Moving objects. Copying objects. Creating a mirror copy of objects. Creation of arrays. Rotate and scale objects. Selection of hatch pattern. Creating and editing layouts. Working with text. Creating and editing tables. Linear dimension. Dimensioning for circle and arc. Measuring angles. Basic and related dimensions. Dimension style. Blocks and external references. Creation of typical solids. Extrude tool in AutoCAD. Materials in AutoCAD. Creation of light sources. Rendering.</p> <p>Classroom sessions: lectures, laboratory classes.</p> <p>Teaching methods: discussion, online.</p> <p>Form of training: full-part</p>
Prerequisites	Knowledge of engineering graphics and infomatics.
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	<p>1. Ванін, В. В. Комп'ютерна інженерна графіка в середовищі AutoCAD [Текст] : навч. посібник для студ. вищих навч. закл. / В. В. Ванін [та ін.]. - К. : Каравела, 2005. - 336 с.</p> <p>2. Інформатика. Інформаційні технології в будівництві. Системи автоматизованого проектування [Текст] : підручник для студ. вищих навч. закладів / В. А. Баженов [и др.]. - К. : Каравела, 2004. - 356 с.</p> <p>3. Чуприн А.И. Трехмерное проектирование. Лекции и упражнения / А. И. Чуприн. - Санкт Петербург: ООО "ДиаСофтЮп", 2002. - 516 с.</p>	
Location and logistics	Computer classroom, projection equipment	
Semester control, examination methods	tests, module test	
Department	Computer technologies of airport construction and reconstruction	
Faculty	Architecture, civil engineering and design	
Professor		<p>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</p>
Originality of academic discipline	Author's course	
Link to discipline		