



Computer Graphics

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	<i>First (bachelor's)</i>
Field of knowledge	<i>10 Natural sciences</i>
Speciality	<i>105 Applied Physics and Nanomaterials</i>
Educational program	<i>105 Applied Physics and Nanomaterials</i>
Discipline status	<i>Normative</i>
Form of study	<i>full-time / remote</i>
Year of preparation, semester	<i>1 course, spring semester</i>
Scope of discipline	<i>2 (60);</i>
Semester control / control measures	<i>Passed</i>
Timetable	<i>Lecture – biweekly (18 hours) Computer workshop – biweekly (18 hours)</i>
Language of instruction	<i>English</i>
Information about the course instructor / teachers	<i>Department of Descriptive Geometry, Engineering and Computer Graphics (building 7, room 815), e-mail: http://geometry.kpi.ua/ Phone: +380 44 204 94 46 Nadkernychna Tetyana Mykolayivna e-mail: t_nadker@ukr.net, mobile tel. 0953340464</i>
Course Placement	https://drive.google.com/drive/folders/1WPhzOACBUjeO1Y2fUA6a71N-2AyeBgDZ?usp=sharing

The program of the discipline

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

After mastering the course, students are able to demonstrate the following learning outcomes:

The purpose of the credit module is to develop students' abilities to:

- GC-1 Ability to apply knowledge in practical situations.
- GC-2 Knowledge and understanding of the subject area and understanding of professional activities.
- GC-7 Ability to learn and master modern knowledge.
- FC 2 Ability to carry out scientific and technical developments in the field of applied physics and nanomaterials in accordance with the task
- FC 3 Ability to independently master new technologies, including those from related industries, to solve production problems

The main tasks of the credit module.

According to the requirements of the program of the discipline, students must demonstrate the following learning outcomes after mastering the credit module:

knowledge:

- projection methods of construction and study of spatial objects based on their flat images on drawings;

- requirements of existing state, interstate and world standards that operate on the territory of Ukraine and are used in the construction of technical documentation in industry;
- capabilities of modern graphic editors for modeling objects, performing and editing their images and drawings, as well as preparing design and technological documentation;
- on fundamental graphic and information training with a focus on the professional profile of the faculty.

Skill:

- UM 14 To implement the acquired fundamental knowledge for the development of new scientific methods, the latest technologies and samples of new equipment of the basic principles of geometric modeling of objects;
- perform and read projection images of any geometric and technical objects;
- use the drawing as a flat geometric model of the object, on which you can study the same geometric parameters as on the real product;
- analyze and search for the optimal solution to solve the tasks on a complex drawing;
- draw up design documents in accordance with the requirements of current standards;
- perform design and technological documents using computer-aided design systems;
- apply knowledge of computer graphics, modern information technologies in the study of other disciplines and in future professional activities;
- create and use drawings at different stages of design.

experience:

- execution of a drawing with the help of drawing tools, as well as computer-aided design systems;
- work with information and design tools;
- information management by information and technical means;
- knowledge of appropriate terminology and use of reference literature;

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

The discipline "Computer Graphics" forms the engineering and technical component in the training program of the future specialist.

Students will be able to apply the obtained learning outcomes in the preparation of the following subjects: classical mechanics (GC08); Field Theory (ZO09); quantum mechanics (GC10); in Statistical Radiophysics and Optics (ZV2 N/D).

3. The content of the discipline

*A list of sections and topics of the entire **discipline** is provided.*

Form of study	Semester (credit) modules	Total credits/hours	Distribution of study time by types of classes			Semester Certification
			Lecture	Computer Practicum	SRS	
Day	Just	2/60	18	18	24	
	1	2/60	18	18	24	Passed

The course material is divided into three sections:

Chapter 1. Entry. Graphical interface of the program.

Chapter 2. Building and editing 2D graphic objects.

Chapter 3. Solid modeling.

The main goals of computer workshops are: mastering specific typical construction techniques, acquiring practical skills in drawing and solid modeling.

4. Training Materials & Resources

Basic literature:

1. *Computer Graphics Course in AUTOCAD Environment. THEORY EXAMPLES. TASKS* [Electronic resource]: study. Helps. for students. specialty 105 "Applied Physics and Nanotechnology", specialization "Applied Physics" / T.M. Nadkernichna, O.A. Lebedeva; KPI them. Igor Sikorsky. – Kyiv : KPI them. Igor Sikorsky, 2020. – 191 p. Recommended by the Methodological Council of KPI. Igor Sikorsky Kyiv Polytechnic Institute as a textbook for bachelor's degree applicants in the specialty 105 Applied Physics and Nanomaterials. http://geometry.kpi.ua/files/Literature/Autocad_2020_Nadkernichnaya_Lebedeva.pdf
2. *Methodical Instructions for Geometric and Projection Drawing / Compiled by G.M. Koval.-K.:* NTU "KPI", 2014 – 36 p. http://geometry.kpi.ua/files/metod_kovalj.pdf

Further reading:

1. Vanin V.V., Blyok A.V., Gnitetska G.O. *Design of design documentation. Manual. 4th ed., repr. And additional.* – K.: Karavela, 2012.-200p. http://geometry.kpi.ua/files/Vanin_Gniteckaja_kd1_2.pdf
2. DSTU ISO 5457:2006 *Technical documentation for products. Drawings. Sizes & Formats*
3. DSTU GOST 2.104:2006 *Unified system of design documentation. Basic inscriptions.*
4. Mikhailenko V.E., Kislookiy V.I., Lyashchenko A.A. *Geometric Modeling and Machine Graphics in CAD.-Higher School, 1991.*

All this literature is available in sufficient volume in the library of NTUU "KPI".

Information Resources

1. Short Lecture Course on Engineering Graphics <http://ela.kpi.ua/handle/123456789\6764>
2. Campus <http://login.kpi.ua/>.
3. Library <ftp://77.47.180.135/>.
4. Methodical documentation of the website of the Department of http://ng-kg.kpi.ua/index.php?option=com_content&view=article&id=37:2010-06-05-04-40-02&catid=71:narisnauch1&Itemid=13

Educational content

5. Methods of mastering the discipline (educational component)

The program of the discipline provides for lectures and computer workshops. In the case of distance learning mode, it is possible to use courses posted on the Sikorsky platform: problem-based, visualized lectures on the Zoom platform

Chapter 1. Entry. Graphical interface of the program.

Topic 1.1. Subject and objectives of the course. Introduction to AutoCAD CAD

Lecture 1. General requirements for the execution of design documents. Formats, main inscription, lines on drawings. Introduction to AutoCAD. ACAD window. The boundaries of the drawing and its display on the screen. Create and install layers. Specify the coordinates of points in the drawing. Line command and Erase, Copy, Commands for generating textual information in the drawing. Creating Text Styles

Computer Practicum 1. Graphical interface of the program. Configuring drawing parameters in AutoCAD. Set the boundary of the drawing and display it on the screen. Create and install layers. Specifies the coordinates of points in the drawing. Setting coordinates in AutoCAD. Building a frame and a main inscription.

Chapter 2. Building and editing 2D graphic objects.

Topic 1.2. Drawing generation commands. editing, textual information.

Lecture 2. Drawing generation commands using graphic primitives Xline, Circle, Ellipse, Polygon, Rectang, Spline. Image editing commands Trim, Extend, Move, Offset.

Lecture 3. Dimensions in the drawings. Create dimension styles. Dimensioning in the ASAD system. Examples of execution.

Lecture 4. Projection drawing. Images (types – main, additional, local). Analysis of the shape of the model, dividing it into simple geometric shapes. Organization of work in ASAD when constructing a projection drawing.

Use object snaps and Polar Tracking mode to build three types of models.

Lecture 5. Standard images are sections. Graphic designations of materials. Use the Bhatch command to apply hatching. Dimensioning.

Computer practicum 2, 3. Execution of a geometric drawing – conjugation according to an individual task. Drawing design.

Computer Practicum 4, 5. Execution of a drawing of a geometric model (construction of views, sections) according to an individual task. Drawing design.

Chapter 3. Solid modeling.

Topic 3.1. 3D Modeling workspace interface.

Lecture 6. Fundamentals of working in three-dimensional space. Means of navigation and identification of species. Coordinate systems. Coordinate filters. User's coordinate system. Working with view screens in three-dimensional space. Three-dimensional primitives. Building a model using basic three-dimensional primitives (box, sphere, cylinder, cone, wedge, torus). Creation of a projection drawing from a 3D image.

Lecture 7. Creation of three-dimensional objects by ejection (extrusion) and the Presspull command. Modeling of objects of complex shape using Boolean operations. Examples of execution.

Lecture 8. Create three-dimensional objects by rotating. Editing the shape of solids. Chamfering and conjugation of faces of solids.

Lecture 9. Review lecture. Preparation for the test.

Computer Practicum 6. Work in three-dimensional space. Three-dimensional primitives.

User's coordinate system. Working with view screens in three-dimensional space. Commands for constructing three-dimensional primitives.. Creation of a projection drawing from a 3D image. Construction of three-dimensional primitives according to an individual task.

Computer Practicum 7. Construction of a three-dimensional model of a complex shape according to an individual task Creation of a three-dimensional model by ejection and Boolean operations Construction of a three-dimensional model of a complex shape according to an individual task

Computer Practicum 8. Creating three-dimensional objects by rotating. Editing the shape of solids. Construction of chamfers and conjugation of faces of solids. Building a three-dimensional model – shaft.

Computer Practicum 9. The last lesson according to the schedule is allotted for a semester control event (credit).

The student's independent work involves the preparation of the student for the computer workshop and test.

Policy & Control

6. Academic discipline policy (educational component)

The system of requirements that the teacher sets for the student/graduate student is indicated:

- rules for attending classes (both lectures and computer workshops);
- rules of conduct in the classroom (activity, preparation of short reports or texts, turning off phones, using communication tools to search for information on the teacher's Google Drive or on the Internet, etc.);

- rules for the protection of computer workshops;
- rules for the protection of individual tasks;
- rules for assigning incentive and penalty points;
- deadline and retake policy;
- academic integrity policy;
- other requirements that do not contradict the legislation of Ukraine and regulatory documents of the University.

Academic Integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: <https://kpi.ua/code>

Standards of Ethical Conduct

The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: <https://kpi.ua/code>

Procedure for appealing the results of control measures

Students have the opportunity to raise any issue that relates to the control procedure and expect it to be dealt with according to predetermined procedures.

7. Types of Control and Rating System for Assessment of Learning Outcomes (CRO)

Current control: express control, defense of computer workshops.

Calendar control: it is carried out twice a semester as a monitoring of the current state of fulfillment of the requirements of the syllabus.

Conditions for admission to semester control: enrollment of all computer workshops.

Graphic works.

1. Execution of the conjugation drawing (A3).

2. Drawing a geometric model (A3).

Tasks for a computer workshop.

1. Execution of a geometric drawing – conjugation according to an individual task.

2. Drawing a geometric model (views, sections)

3. Construction of three-dimensional primitives and creation of a projection drawing based on a 3D image.

4. Building a three-dimensional model of a complex shape.

5. Construction of bodies of rotation.

Express tests are carried out in the form of a programmed control of students' knowledge at the end of each topic at the beginning of the practical lesson for 40 minutes. Individual tasks of programmable control over the subject and complexity correspond to the exercises that students perform at the computer workshop.

The results of the test are communicated to students in the same practical lesson. Such a schedule of tests ensures the systematic work of students during their study of this discipline and, as experience shows, significantly affects the improvement of the quality of education. Individual tasks are selected in such a way that their implementation requires updating students' knowledge both from the lecture course and obtained in the process of completing tasks for each section of the computer workshop. The topics of individual tasks are provided on the website of the department, and are also attached to the work program.

Calendar control: carried out twice a semester as a monitoring of the current state of fulfillment of the requirements of the syllabus.

Semester control: credit.

Conditions for admission to semester control: minimum positive mark for an individual assignment / enrollment of all laboratory work / semester rating of more than 60 points.

Table of correspondence of rating points to grades on the university scale:

<i>Score</i>	<i>Score</i>
100-95	Perfectly
94-85	Very good
84-75	Well
74-65	Satisfactory

64-60	Enough
Less than 60	Disappointing
Admission conditions are not met	Not allowed

Criteria for awarding points based on the results of the student's work:

Express control and work (total 30 points (3x10)).

Graphic works (total 20 points (10x2)).

Computer workshop (total 50 points (10x5)).

8. Additional information on the discipline (educational component)

The list of questions that are submitted for semester control is posted in Appendix 1.

Work program of the discipline (syllabus):

Compiled by Senior Lecturer Nadkernychna Tetyana Mykolayivna.

Approved by the Department of Descriptive Geometry, Engineering and Computer Graphics (Minutes No. 6 of 25.05.2023 years)

Approved by the Academic Council Of the NSPTI (Minutes No. 6 of 29.06.2023 years).

List of questions for semester control.

1. Scale.
2. Types of lines.
3. Formats.
4. Species. Main types.
5. Cuts. The cuts are simple.
6. What are the possibilities for creating a new blueprint?
7. What are workspaces like? How is the transition between them carried out?
8. How is the feed organized?
9. Specifies the coordinates of points in the drawing.
10. Object snapping. What are they used for?
11. How do I create new layers and what are they used for?
12. What is the difference between the LINE and XLINE, LAYER commands?
13. Capabilities of the COPE team?
14. Which command is used to perform hatching?
15. What is the ARRAY command used for?
16. What is the polar and object tracking tool?
17. Setting three-dimensional coordinates? User's coordinate system.
18. Primitives. What options does the BOX primitive have?

- 19. Primitives. What options does the CYLINDER primitive have?**
- 20. Primitives. What options does the SPHERE primitive have?**
- 21. Primitives. What options does the CONE primitive have?**
- 22. Primitives. What options does the WEDGE primitive have?**
- 23. Primitives. What options does the TORUS primitive have?**
- 24. Primitives. What options does the PYRAMID primitive have?**
- 25. Features of creating solid-state objects by extrusion (EXTRUDE).**
- 26. Features of creating solid-state objects by rotation (REVOLVE).**
- 27. Features of creating solid-state objects using the PRESSPULL command. Difference between EXTRUD and PRESSPULL commands.**
- 28. Boolean surgeries. What are they used for.**
- 29. Action of the INTERFERENCE command. Difference between INTERSECT and INTERFERENCE teams.**
- 30. Creation of VIEWPORTS. What are they used for?**