



ENGINEERING AND COMPUTER GRAPHICS - 1

Working program of the academic discipline (Syllabus)

Details of the academic discipline

Level of higher education	<i>First (undergraduate)</i>
Branch of knowledge	<i>17. Electronics and telecommunications</i>
Specialty	<i>171. Electronics</i>
Educational program	<i>171. Acoustic electronic systems and acoustic information processing technologies 171. Electronic components and systems 171. Electronic devices and devices 171. Electronic multimedia systems and Internet</i>
Discipline status	<i>Normative</i>
Form of education	<i>full-time (day)/distance/mixed</i>
Year of training, semester	<i>1st year, autumn / spring semester</i>
Scope of the discipline	<i>6 (180)</i>
Semester control/ control measures	<i>Autumn semester - assessment, spring - exam</i>
Lessons schedule	<i>Autumn semester: lecture – once every two weeks (18 hours); practical classes - once every two weeks (18 hours). Spring semester: lecture – once every two weeks (18 hours); practical classes - once every two weeks (18 hours); computer workshop - once every two weeks (18 hours).</i>
Language of teaching	<i>Ukrainian</i>
Information about head of the course / 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 Lecturer: Ph.D., associate professor, Tetyana Vitaliyivna Hnitetska, gnitetsk@ukr.net, 066 735 75 41¹ Practical classes: Ph.D. of Pedagogy, associate professor, Hnitetska Halyna Omelyanivna, gnitetsk@ukr.net, 050 710 41 87² Computer workshop: Ph.D., associate professor, Tetyana Vitaliyivna Hnitetska, gnitetsk@ukr.net, 066 735 75 41³</i>
Placement of the course	https://do.ipk.kpi.ua/course/view.php?id=1995

Program of educational discipline

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

The main goal of teaching the discipline "Engineering and computer graphics" is the formation of students' competences in the system of basic knowledge from the main sections of the course, gaining work experience and applying methods of geometric modeling of spatial forms, creating and designing design documentation using CAD AutoCAD with the application of requirements standards.

The syllabus is structured in such a way that to complete each subsequent task, students need to apply the skills and knowledge acquired in the previous one. Special attention is paid to the principle of encouraging students to study actively. This is facilitated by the organization of independent work of students with the help of sets of methodical materials presented on the Sikorsky distance learning platform, including video lessons that are effective in the organization of distance learning. At the same time, students must perform practical tasks that will allow them to solve real tasks in their professional activities in the future. During training, the following are used:

- active and collective learning strategies;
- personality-oriented developing technologies based on active forms and methods of learning (team-based learning, independent work and independent study of individual topics of the discipline).

As a result of studying the "Engineering and computer graphics" discipline, students acquire the following competencies:

загальні:

1. ability to apply knowledge in practical situations (3K 1);
2. knowledge and understanding of the subject area and understanding of professional activity (3K 2)
3. the ability to communicate in the national language both orally and in writing (3K 3);
4. the ability to learn and master modern knowledge (3K 6);
5. the ability to realize one's rights and responsibilities as a member of society, to be aware of the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine (3K 13);
6. the ability to preserve and multiply the moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types of motor activity for active recreation and leading a healthy lifestyle (3K 14).

professionals:

1. the ability to use knowledge and understanding of scientific facts, concepts, theories, principles and methods for the design and application of electronics devices, devices and systems (CK1);
2. the ability to perform analysis of the subject area and regulatory documentation. Necessary for the design and application of electronics devices, devices and systems (CK2);
3. the ability to apply appropriate mathematical, scientific and technical methods, modern information technologies and computer software. Skills of working with computer networks, databases and Internet resources for solving engineering problems in the field of electronics (CK5);
4. the ability to apply creative and innovative potential in the synthesis of engineering solutions and in the development of structures of electronic devices and systems (CK7);
5. the ability to apply industry standards and quality standards for the functioning of electronic devices and systems in practice (CK10).

program learning outcomes:

1. use documentation related to professional activities, using modern technologies and office equipment, use the English language, including special terminology for communicating with specialists, conducting literature searches and reading texts on technical and professional topics (P12);
2. be able to learn new knowledge, progressive technologies and innovations, find new unconventional solutions and means of their implementation, meet the requirements of flexibility in overcoming obstacles and achieving the goal, rational use and rationing of time, discipline, responsibility for one's decisions and activities (P13);
3. adhere to the norms of modern Ukrainian business and professional language (P14);

4. to demonstrate the skills of independent and collective work, leadership qualities. To organize work under conditions of limited time with an emphasis on professional integrity (P15). The above-mentioned competences and program learning outcomes of the discipline "Engineering and computer graphics" are ensured thanks to the knowledge of students:

- basics of descriptive geometry;
- basics of geometric modeling;
- trends in the development of modern information technologies;
- universal automated design system AutoCAD;
- methods of development of design and construction documentation according to the requirements of the standards..

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 discipline lays the foundations for studying other disciplines: informational basics of electronics; fundamentals of design in electronics; computer science; measurement techniques; analytical geometry; higher mathematics; technologies of virtual devices; course and diploma design, etc., as well as from disciplines that involve the ability to create and design traditional projection and electronic drawings of products with the help of modern CAD, geometric and computer 3d modeling of electronic equipment objects from the cycle of disciplines of professional and practical training of students, who study in senior courses.

3. Content of the study discipline Engineering and computer graphics. Fundamentals of geometric modeling.

Chapter 1. Representation of point, line, and plane models in the system of projection planes.

Topic 1.1. Projection methods: central and parallel. Orthogonal projection is the main method of construction of technical drawings. Specifying the position of the point model in the system of projection planes. Creation of a complex drawing point. Position of points in space relative to projection planes. Direct and inverse tasks (construction and reading of a projection drawing).

Topic 1.2. Representation of the straight line model in the system of projection planes. Specifying a straight line on the plot. Lines of a separate position: level and projecting. The line of general position. Traces of a straight line. Belonging to a point is a straight line. Division of a line segment in the given ratio. Modeling the mutual position of straight lines in space: parallelism, intersection, transience.

Topic 1.3. Representation of the plane model in the system of projection planes. Setting the plane on the drawing. Planes of a separate position: level and projecting. Trace-projection of the plane of a separate position. Planes of general position. Belonging to a line and a point in a plane. Modeling the relative position of planes in space: parallelism, intersection (separate cases).

Chapter 2. Methods of simplifying the solution of problems for modeling geometric objects in the space of the system of projection planes.

Topic 2.1. The method of replacing projection planes. The main tasks of the method of replacing the projection planes on the example of the line segment of the general position and the plane of the general position. Determination of the natural magnitude of a dihedral angle. Construction of a natural size of a flat figure.

Chapter 3. Modeling of curved lines and surfaces.

Topic 3.1. Flat and spatial curved lines. Class and order of the curve. Methods of modeling curved lines of the second order. Circle projection.

Topic 3.2. Surfaces. Surface modeling methods. Determinants of surfaces. Expandable and non-expandable linear surfaces. Surfaces of rotation. Construction of points and lines on surfaces.

Chapter 4. Modeling the intersection of geometric elements.

Topic 4.1. Modeling the intersection of surfaces with a plane. General method of crossing surfaces with a plane. Four classes of problems. Construction of the line (figure) of the intersection of second-order surfaces by planes of individual and general position. Determination of the natural size of the cross-sectional figure. Sweeps.

Topic 4.2. Single and double penetration. The general method of solving problems on the penetration of surfaces with symmetric and asymmetric horizontal "windows". Concept of view and simple section.

Topic 4.3. Intersection of surfaces. Method of mediators. Individual cases of intersection of second-order surfaces. The use of mediators - planes of a separate position. Method of spherical mediators. Monge's theorem. Conclusions from the theorem.

4. Educational materials and resources

Basic literature

1. Інженерна графіка: підручник для студентів вищих закладів освіти I - II рівнів акредитації/ В.Є.Михайленко, В.В.Ванін, С.М.Ковальов; За ред. В.Є.Михайленка. -Львів: Піча Ю.В.; К.: Каравела; Львів: Новий світ - 2000. - 284.
2. Ванін В.В.,Блюк А.В.,Гнітецька Г.О. Оформлення конструкторської документації:Навч.посіб. 3-є вид.- К.: Каравела, 2012.-200 с.
http://geometry.kpi.ua/files/Vanin_Gniteckaja_kd1_2.pdf
3. Ванін В.В, Перевертун В.В, Надкернична Т.М. та ін. Інженерна та комп'ютерна графіка. К.: Вид.гр.ВНУ, 2009. — 400 с.
Додаткова література
- 5 Михайленко В.Є., Ванін В.В., Ковальов С.М. Інженерна та комп'ютерна графіка. — К.: Каравела, 2012. — 363 с.
- 6 Хаскін А.М. Креслення. — К.: Вища шк., 1985. — 440 с.

All the mentioned literature is available in sufficient quantity in the library of NTUU "KPI".

Information resource

- 7 Complex of methodical materials. Educational platform of distance learning "Sikorsky":<https://do.ipk.kpi.ua/course/view.php?id=1995>
- 8 Complex of methodical materials. Educational platform of distance learning "Sikorsky":
<https://do.ipk.kpi.ua/course/view.php?id=3187>
- 9 Library <ftp://77.47.180.135/>.
- 10 Methodical documentation of the website of the department page [Навчальна та методична література: http://na-kg.kpi.ua/index.php?option=com_content&view=article&id=37:2010-06-05-04-40-02&catid=71:narisnauch1&Itemid=13](http://na-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 an educational discipline (educational component)

The program of the academic discipline provides for lectures and practical classes. Methodical support for studying the course is the use of an information resource that presents a methodological set of materials: a lecture course with a step-by-step explanation of the educational material of individual course topics and the use of animation elements; video lessons; workbook, both in printed version and in the form of a website with an interactive step-by-step solution to homework and classroom tasks, posted on the "Sikorsky" educational platform. In the case of distance learning, all these materials can be used for lectures and practical classes on the Zoom platform, etc., as well as be available when students organize independent work as part of remote access to information resources at a time convenient for them.

Lecture classes

№ 3/Π	Topics of lectures
1	<p>Projection methods. Central and parallel projection. Geometric modeling of spatial objects. Projection of a point on three mutually perpendicular planes. Complex point drawing. Methods of constructing the third projection of a point. Position of points relative to projection planes. Direct and inverse problems. Determination of the distance from a point to the planes and axes of the projections. Competing points.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p> <p>Recommended Books: [1]</p> <p>IWS: <i>Doing homework in the workbook on this topic.</i></p>
2	<p>Straight line projection. Specifying a straight line on the plot. Lines of a special position: level and projecting. The line of general position. Determination of the natural value of the line segment of the general position and the angles of inclination of the line to the projection planes. Belonging of a point to a straight line. Division of a line segment in a given ratio. Traces of a straight line. The relative position of two straight lines.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p> <p>Recommended Books: [1]</p> <p>IWS: <i>Doing homework in the workbook on this topic.</i></p>
3	<p>Projection of the plane. Specifying the plane on the epurse. Areas of special position. Trace-projection of the plane of a special position. Planes of general position. Belonging to a line and a point in a plane. The relative position of two planes. Curved lines Parallelism of planes. Intersection of planes of a special position. Intersection of planes of general and special position.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p> <p>Recommended Books: [1]</p> <p>IWS: <i>Doing homework in the workbook on this topic.</i></p>
4	<p>Methods of simplifying course problem solving. The method of replacing projection planes.</p> <p>Didactic tools https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p> <p>Recommended Books: [1]</p> <p>IWS: <i>Doing homework in the workbook on this topic.</i></p>
5	<p>Curved lines. Classification of curved lines. Circle projection.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p> <p>Recommended Books: [1]</p> <p>IWS: <i>Doing homework in the workbook on this topic.</i></p>
6	<p>Methods of specifying surfaces, their definition, classification. Expandable and non-expandable linear surfaces. Surfaces of rotation. Construction of points and lines on the surface, conditions for their belonging to the surface.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course.</p>

	<p>Recommended Books: [1] IWS: <i>Doing homework in the workbook on this top.</i></p>
7	<p>Intersection of surfaces by a plane. General method of crossing surfaces with a plane. Construction of the line (figure) of the intersection of second-order surfaces by planes of individual and general position. Determination of the natural size of the cross-sectional figure. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; робочий зошит з курсу. Recommended Books: [1] IWS: <i>Doing homework in the workbook on this topic.</i></p>
8	<p>Intersection of surfaces of bodies. Single and double penetration. General method of solving problems. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course. Recommended Books: [1], ГОСТ 2.305-68. IWS: <i>Doing homework in the workbook on this topic.</i></p>
9	<p>Intersection of surfaces. Individual cases of intersection of surfaces, use of mediators - planes of a separate position, spheres. Monge's theorem. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook from the course. Recommended Books: [1]. IWS: <i>Doing homework in the workbook on this topic.</i></p>

Practical training

The name of the practical session	Number classroom hours
<p>Practical lesson 1. Point projection. Solving problems on a complex drawing. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks). Recommended Books: [1]. IWS: <i>Doing homework in the workbook on this topic. (tasks 1 - 10).</i></p>	2
<p>Practical lesson 2. Setting a straight line on a graph. Solving problems on a complex drawing. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks). Recommended Books: [1]. IWS: <i>Doing homework in the workbook on this topic. (tasks 22 - 26).</i></p>	2
<p>Practical exercise 3. Setting the plane on the epurse. Solving problems on a complex drawing. Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks). Recommended Books: [1]. IWS: <i>Doing homework in the workbook on this topic. (tasks 35 - 38).</i></p>	2

<p>Practical lesson 4. The method of replacing projection planes. Solution of the problems of the method of replacing the projection planes using the example of the line segment of the general position and the plane of the general position.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks).</p> <p>Recommended Books: [1].</p> <p>IWS: Doing homework in the workbook on this topic. (tasks 10 -13).</p>	2
<p>Practical lesson 5. Curved lines. Solving problems on the projection of a circle.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks).</p> <p>Recommended Books: [1].</p> <p>IWS: Doing homework in the workbook on this topic. <i>мемою</i> (tasks 95, 96).</p>	2
<p>Practical lesson 6. Surfaces. Solving problems on the construction of points and lines on surfaces.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks).</p> <p>Recommended Books: [1].</p> <p>IWS: Doing homework in the workbook on this topic. (tasks 95, 96).</p>	2
<p>Practical lesson 7. Intersection of surfaces by a plane. Solving problems on the intersection of surfaces with a plane. Construction of the natural size of the cross-sectional figure. Modular control work.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks).</p> <p>Recommended Books: [1].</p> <p>IWS: Doing homework in the workbook on this topic. (tasks 100, 101).</p>	2
<p>Practical lesson 8. Solving problems for the construction of single and double penetration of bodies through horizontal "windows". Designing the work according to the requirements of the standards.</p> <p>Didactic tools: https://do.ipk.kpi.ua/course/view.php?id=1995; https://do.ipk.kpi.ua/course/view.php?id=3187; workbook (theoretical information on the topic of the lecture and conditions for homework and classroom tasks).</p> <p>Recommended Books [2], <i>ГОСТ 2.305-68</i>.</p> <p>IWS: Doing homework in the workbook on this topic. (tasks 109, 110).</p>	2
<p>Practical lesson 9. Assessment.</p>	2

6. Independent work of a student

Hours assigned to the student's independent work are specified in clause 5. The method of mastering the academic discipline is the performance of homework, preparation for the performance of work in practical classes; execution of calculation and graphic work, as well as preparation for modular control work and assessment.

Policy and control

7. Policy of academic discipline (educational component)

Studying the academic discipline "Engineering and computer graphics. "Computer engineering graphics" requires a higher education applicant to:

- observance of educational and academic ethics;
- compliance with the schedule of the educational process;

- be balanced, attentive in classes;
- systematically study theoretical material;
- compliance with the schedule of protection of graphic works, computer workshop, calculation and graphic work. The applicant's answer must show signs of independent performance of the assigned task, absence of signs of repetition and plagiarism.

If the student of higher education was absent from the lecture, then he should practice this lecture at another time (with another group, at a consultation, on his own, using methodical materials presented on the Sikorsky distance learning platform, video recordings, etc.).

If the student of higher education was absent from a practical lesson or computer workshop, he should work through the material of this practical lesson or computer workshop at another time (with another group, at a consultation, independently, using methodical materials presented on the distance learning platform Sikorskyi, video recordings, etc.).

8. Types of control and rating system for evaluating learning outcomes (ELO)

The student's rating is calculated on a 100-point scale.

1. The student's credit module rating consists of the points he receives for:
 - homework and classroom tasks (DZ) on the topic of the lecture in the workbook (7 tasks);
 - programmable control (PC) (4 PCs);
 - execution of modular control work;
 - performance and protection of graphic works (WG) (2 tasks);
 - implementation and protection of graphic and calculation work (RGR).
2. Scoring criteria:
 - 2.1. Completion of the tasks in the workbook is evaluated in 5 points according to the following criteria:
 - flawlessly executed work, excellent graphics, work submitted on time - 5 points;
 - there are certain shortcomings in the execution, good schedule, violation of the schedule of delivery up to 2-3 weeks - 3 points;
 - there are significant shortcomings in execution, satisfactory graphics, untimely submitted work - 2 points;
 - 2.2. Programmable control (PC) (4 PCs);
 - flawlessly performed work – 5 points;
 - there are certain shortcomings in performance – 3 points;
 - there are significant shortcomings in performance - 2 points;
 - 2.3. The performance of the modular control work is assessed at 15 points:
 - flawlessly performed work - 15 points;
 - non-significant shortcomings in the performance of work - 12 points;
 - significant shortcomings in the performance of work - 8 points;
 - work performed incorrectly or not performed at all - 0 points.
 - 2.4. The execution and protection of graphic works is evaluated in 5 points:
 - flawlessly executed work, excellent graphics - 5 points;
 - there are certain shortcomings in the execution, good schedule, violation of the schedule of delivery up to 2-3 weeks - 3 points;
 - there are significant shortcomings in execution, satisfactory graphics - 2 points;
 - 2.5. Completion of calculation and graphic work is estimated at 20 points:
 - flawlessly performed work - 20 points;
 - there are not significant shortcomings in the performance of work - 18 points;
 - there are significant shortcomings in the performance of work - 8 points;
 - work performed incorrectly or not performed at all - 0 points.

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

The condition of the first calendar control is to obtain at least 18 points and perform and defend three topics in the workbook, one graphic work, and receive a positive evaluation from two programmed control works. The condition of the second calendar control is to obtain at least 45 points and perform and defend three topics in the notebook, one graphic work, receive a positive grade from two programmed control works and perform calculation and graphic work. The condition for obtaining a credit is the completion and protection of calculation and graphic work, problems in the workbook with 7 course topics, 2 graphic works, receiving positive grades from four programmed control works and a modular control work.

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

<i>Scores</i>	<i>Rating</i>
100-95	Perfectly
94-85	Very good
84-75	Fine
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily
Admission conditions not met	Not allowed

9. Additional information on the discipline (educational component)

Passing of the exam takes place by tickets. The ticket consists of two tasks. The condition of the first task includes the educational material studied in the first theoretical part of the course. Knowledge of projection methods and methods of simplifying the solution of course problems are tested. The second task is complex. The obtained competences of modeling geometric objects, the ability to apply the requirements of standards when drawing up design documentation are checked.

Working program of the academic discipline (syllabus):

Compiled by: Associate Professor of the Department of Graphic Geometry, Engineering and Computer Graphics, Ph.D. Hnitetska T.V.

Approved by the _NGIKH_ department (protocol No. _10_ dated 11.06.2024)

Agreed by the Methodical Commission of the Faculty of Electronics (protocol No. 6/2024 dated 27.06.2024)