



# ENGINEERING & 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>13. Mechanical Engineering</i>
Speciality	<i>131. Applied Mechanics</i>
Educational programs	<i>Automated and Robotic Mechanical Systems ER MMI Dynamics and strength of ER MMI machines Construction and design of ER MMI machines Technologies for the production of ER MMI aircraft Mechanical Engineering Technologies ER MMI</i>
Discipline status	<i>Normative</i>
Form of study	<i>full-time (full-time)/remote/mixed</i>
Year of preparation, semester	<i>1st year, autumn semester</i>
Scope of discipline	<i>4 ECTS credits, 120 hours, lectures – 36 hours, practical – 36 hours, CPC – 48 hours.</i>
Semester control / control measures	<i>Credit, MKR, WGR</i>
Timetable	<i>According to the schedule of the University of <a href="https://schedule.kpi.ua/">https://schedule.kpi.ua/</a></i>
Language of instruction	<i>Ukrainian</i>
Information about Course Leader / Instructors	<i>Department of Descriptive Geometry, Engineering and Computer Graphics (building 7, room 815), e-mail: <a href="http://geometry.kpi.ua/">http://geometry.kpi.ua/</a> Phone:+380 44 204 94 46 Lecturer: Ph.D., Associate Professor, Zalevsky Sergey Vladimirovich, <a href="mailto:zalsergkpi@gmail.com">zalsergkpi@gmail.com</a>, 067 810 18 84 Practical classes: Ph.D., Associate Professor, Zalevsky Sergey Vladimirovich, <a href="mailto:zalsergkpi@gmail.com">zalsergkpi@gmail.com</a>, 067 810 18 84</i>
Course Placement	<a href="https://do.ipk.kpi.ua/course/view.php?id=3281">https://do.ipk.kpi.ua/course/view.php?id=3281</a> <a href="https://do.ipk.kpi.ua/course/view.php?id=3601">https://do.ipk.kpi.ua/course/view.php?id=3601</a>

### The program of the discipline

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

*The purpose of the discipline is to form students' abilities to model technical products by geometric methods, build and design their technical drawings in accordance with existing standards; use of information and design systems in their professional activities.*

*The syllabus is structured in such a way that to complete each subsequent task, students need to apply the skills and knowledge gained in the previous one. Particular attention is paid to the principle of encouraging students to actively learn. This is facilitated by the organization of students' independent work with the help of sets of methodological materials posted on the Sikorsky distance learning platform, including video lessons, which are effective in organizing distance learning. At the same time, students*

have to perform practical tasks that will allow them to solve real problems in their professional activities in the future. During the training, the following are used:

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

**The study of the discipline will allow you to form the following competencies:**

**General Competencies**

- GC9. Skills in the use of information and communication technologies.

**Professional competencies:**

- FC7. Ability to apply computerized design (CAD), manufacturing (CAM), engineering research (CAE) systems and specialized application software to solve engineering problems in applied mechanics.
- FC8. Ability to spatial thinking and reproduction of spatial objects, structures and mechanisms in the form of projection drawings and three-dimensional geometric models;

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

**Program Learning Outcomes:**

- PH5. Perform geometric modeling of parts, mechanisms and structures in the form of spatial models and projection images and draw up the result in the form of technical and working drawings.
- PH12. Practical use skills in computer-aided design (CAD), pre-production (CAM), and engineering research (CAE).

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

According to the structural and logical scheme of educational programs, the educational component "Engineering and Computer Graphics" is taught in the first semester of the first year of study of applicants for higher education at the bachelor's level. To master the discipline, knowledge and skills formed on the basis of complete secondary or secondary vocational education are sufficient.

In turn, the discipline lays the foundations for the study of the following disciplines: "Metrology, Standardization and Certification"; "Machine Parts and Fundamentals of Design", as well as other disciplines that involve the ability to create and design product drawings, perform geometric and computer 3D modeling of mechanical engineering objects, course and diploma design.

## **3. The content of the discipline Engineering and Computer Graphics.**

### **Section 1 Projection Methods**

**Topic 1.1.** Introduction. Subject and objectives of the course. The history of the development of images. The Role of Outstanding Geometers in the Development of Image Theory. ESKD system of standards - basic provisions. Formats. Scale. Line. Fonts. Geometric drawing. Conjugation of geometric elements. Basic requirements for applying dimensions on the drawing.

**Topic 1.2.** Projection methods. Center and parallel projection. Point projection. Complex point drawing. Ways to build the third projection of a point. The position of points relative to the projection planes. Direct and inverse problems.

**Topic 1.3.** Define a line on a diagram. Lines of special position : level and projection. Straight line of general position. A point belongs to a line. Division of a line segment in a given relation. The relative position of two straight lines. Method of replacing projection planes.

**Topic 1.4.** Plane projection. Define a plane on a diagram. Planes of special position: level and projection. Trace projection of a plane of special position. Planes of general position. Belonging to a line and a point

to a plane. Parallelism of planes. Intersection of planes of special position. Intersection of planes of general and special position. Curved lines. Projection of a circle.

**Topic 1.5.** Parallelism of planes. Intersection of planes of special position. Intersection of planes of general and special position. The relative position of a line and a plane. Parallelism and intersection of a line and a plane.

**Topic 1.6.** Perpendicularity of geometric elements. Geometrical locations of points and lines.

**Topic 1.7.** Ways to convert projections.

## **Section 2 Geometric Modeling of Surfaces**

**Topic 2.1.** Curved lines and surfaces.

**Topic 2.2.** Intersection of surfaces by planes.

**Topic 2.3.** Surface sweeps.

**Topic 2.4.** Images: views, sections, sections.

**Topic 2.5.** Intersection of surfaces. Individual cases of intersection of surfaces, the use of intermediaries - planes of special position. Spherical intermediary method. Monge's theorem. Conclusions.

## **Section 3 Types and Rules of Technical Drawings**

**Topic 3.1.** Projection drawing. Basic images. Views, sections, sections. Classification of sections. Simple cuts: horizontal, vertical, inclined. Complex cuts: stepped, broken and combined. Features of their implementation. The main provisions of the GOST 2.305-68 standard: Dimensioning.

**Topic 3.2** Projection drawing.

**Topic 3.3** Sketches and working drawings of parts. Choice of the main view, number of images. Rules for applying dimensions. Images of structural elements of parts: threads, keyways, teeth, splines and technological elements: grooves for the outlet of thread-cutting tools and grinding wheels, center holes. Features of the execution of drawings of parts made by casting.

**Topic 3.4** Design stages. Connection of parts (threading, gluing, soldering, welding). Assembly drawing of the unit. Specification.

## **4. Training Materials & Resources**

### **References**

1. Engineering graphics. Section: Descriptive geometry. Course of lectures. aids. for students. /N.V. Bilytska, O.G. Hetman; – Kyiv : KPI them. Igor Sikorsky, 2021. – 171 p. <https://ela.kpi.ua/handle/123456789/39819>
2. Engineering graphics. Section: Projection drawing Course of lectures: tutorial. aids. for students. /N.V. Bilytska, O.G. Hetman; – Kyiv: KPI them. Igor Sikorsky, 2021. – 72 p. <https://ela.kpi.ua/handle/123456789/39822>
3. Engineering graphics. Section: Machine-building drawing. Course of lectures. aids. for students. /N.V. Bilytska, O.G. Hetman; – Kyiv : KPI them. Igor Sikorsky, 2021. – 95 p. <https://ela.kpi.ua/handle/123456789/39823>
4. Descriptive geometry and engineering graphics: method. incl. to vc. dists. / L.O. Tsvirkun Kryvyi Rih: DonNUET, 2019. – 106 p. [http://elibrary.donnuet.edu.ua/1760/1/MR\\_Narusna%20geometrui.pdf](http://elibrary.donnuet.edu.ua/1760/1/MR_Narusna%20geometrui.pdf)

### **Further reading**

- 5 Methodical instructions on geometric and projection drawings / G.M. Koval.-K.: NTUU "KPI", 2014-36 p. [https://ng-kg.kpi.ua/files/metod\\_kovalj.pdf](https://ng-kg.kpi.ua/files/metod_kovalj.pdf)
- 6 Methodical instructions for performing the task on the topic "Connection" / G.V. Baskova, G.M. Koval.– K.: NTUU "KPI named after Igor Sikorsky", 2017. – 42 p. <https://ng-kg.kpi.ua/files/147.pdf>
- 7 Engineering graphics Development of sketches and working drawings of parts Textbook / V.V.Vanin, O.M.Vorobyov, A.E.Izvolenskaya, N.A.Parakhina, - K.: KPI them. Igor Sikorsky, 2016. - 106 p. -100 pr. [https://ng-kg.kpi.ua//files/0404174\\_Development%20sketches%20.pdf](https://ng-kg.kpi.ua//files/0404174_Development%20sketches%20.pdf)

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

*Information Resource*

- 8 A set of methodical materials. Distance Learning Platform "Sikorsky":  
<https://do.ipk.kpi.ua/course/view.php?id=3281>
- 9 A set of methodical materials. Distance learning platform "Sikorsky":  
<https://do.ipk.kpi.ua/course/view.php?id=3601>
- 10 Library <ftp://77.47.180.135/>.
- 11 Methodical documentation of the department's website, page <https://ng-kg.kpi.ua/>

*Educational and methodical literature:*

[https://ng-kg.kpi.ua/index.php?option=com\\_content&view=article&id=619&Itemid=32](https://ng-kg.kpi.ua/index.php?option=com_content&view=article&id=619&Itemid=32)

**Educational content**

**5. Methods of mastering the discipline (educational component)**

*The program of the discipline provides for lectures and practical classes. Methodological support for the study of the course is the use of an information resource, which presents a methodological set of materials: a lecture course with a step-by-step explanation of the educational material of individual topics of the course and the use of animation elements; video tutorials; workbook, both in print and in the form of a website with an interactive step-by-step solution of home and classroom problems posted on the Sikorsky Learning Platform. In the case of distance learning, all these materials can be used in lectures and practical classes on the Zoom platform, etc., as well as be available in the organization of students' independent work within the framework of remote access to information resources at a convenient time for them.*

**Lectures**

№ Salary	Title of the lecture topic and list of main questions (list of didactic aids, references to literature and tasks for the SRS)
1	Projection method. Central and parallel projection. Complex point drawing. Ways to construct the third projection of a point. The position of the points relative to the planes of projection. Direct and inverse problems. Species. Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> a workbook from the course. Recommended reading: [1], [4], [5]. CPC: Making images of a part.
2	Images: views, sections, sections. Dimensioning. Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook. Recommended reading: [2], [5], [7]. CPC: Making images of a part.
3	Line precision. Complex drawing of a straight line. Straight levels and projections, their properties. Determination of the natural size of a segment of a straight line of general position by replacing the planes of projections. The first and second typical tasks. Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook. Recommended Reading: [1]. CPC: Doing homework in a workbook on a given topic.
4	Projection of a plane and a circle. Define a plane on a diagram. Planes of special position: projection and level. Trace-projection of the plane of special position. Planes of general position. Zero traces of the plane. The belonging of a line and a point to a plane. Conversion of the plane of general position to projection and level.

	<p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook. Recommended Reading: [1].</p> <p>CPC: Doing homework in a workbook on a given topic.</p>
5	<p>Curved lines and surfaces. Plotting points and lines on surfaces.</p> <p>A general technique for constructing points and lines on surfaces. Four types of point-building problems. Drawing a Line on a Surface (Shape)</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended reading: [1], [4].</p> <p>CPC: Doing homework in a workbook on a given topic.</p>
6	<p>Working drawings and sketches of parts. Slicing. Image and notation of the thread on the drawing. Threaded part.</p> <p>Slicing. Image and notation of the thread on the drawing. Threaded part (union nut). Surface roughness. Materials.</p> <p>Didactic aids: reference tables, methodical maps.</p> <p>Recommended Reading: [3], [7].</p> <p>SRS: Processing of lecture materials.</p>
7	<p>Working drawings and sketches of parts of the "Shaft" type.</p> <p>Features of the execution of sketches of parts of the "Shaft" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Shaft" type. Construction of sections.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/development-w-drawings.pdf">http://ng-kg.kpi.ua/files/development-w-drawings.pdf</a></p> <p>Recommended Reading: [3], [7].</p> <p>SRS: Processing of lecture materials</p>
8	<p>Intersection of surfaces with a plane.</p> <p>A general technique for crossing surfaces with a plane. Four types of problems for the intersection of surfaces by a plane. Construction of a line (figure) of intersection of second-order surfaces by planes of separate and general position.</p> <p>Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended Reading: [1].</p> <p>CPC: Doing homework in a workbook on a given topic.</p>
9	<p>Sweep.</p> <p>General method of constructing scans. Construction methods.</p> <p>Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended Reading: [1].</p> <p>SRS: Processing of lecture materials.</p>
10	<p>Intersection of surfaces.</p> <p>Some cases of intersection of surfaces, the use of intermediaries - planes of a separate position, spheres. Monge's theorem. Conclusions of Monge's theorem.</p> <p>Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended Reading: [1].</p> <p>CPC: Doing homework in a workbook on a given topic.</p>
11	<p>Axonometric projections.</p> <p>Types of axonometry. Axonometric projection of a point. Rectangular isometrics and dimetry. Distortion coefficients. Building a circle in axonometry. Ways to build ovals. Axonometric representation of a geometric model.</p> <p>Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended reading: [2], [4].</p> <p>SRS: Processing of lecture materials</p>
12	<p>Working drawings and sketches of parts of the "Cover" type.</p>



	<p>Features of sketching parts of the "Cover" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Cover" type. Construction of sections.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/development-w-drawings.pdf">http://ng-kg.kpi.ua/files/development-w-drawings.pdf</a></p> <p>Recommended Reading: [3], [7].</p> <p>SRS: Processing of lecture materials</p>
13	<p>Working drawings and sketches of parts of the "Hull" type.</p> <p>Features of sketches of parts of the "Body" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Body" type. Construction of sections.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/development-w-drawings.pdf">http://ng-kg.kpi.ua/files/development-w-drawings.pdf</a></p> <p>Recommended Reading: [3], [7].</p> <p>SRS: Processing of lecture materials</p>
14	<p>The joints are threaded and one-piece. Types of standard products with threads. Types of standard products with threads. Standards, dimensions and purpose of standard products. Features of the execution of threaded connections. Registration of the specification.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/development-w-drawings.pdf">http://ng-kg.kpi.ua/files/development-w-drawings.pdf</a></p> <p>Recommended reading: [3], [6].</p> <p>SRS: Processing of lecture materials</p>
15	<p>Single penetration of surfaces.</p> <p>General Method of Solving Problems for Single Penetration of Surfaces. The main provisions of the GOST 2.305-68 standard. Dimensioning.</p> <p>Teaching aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ; Course workbook.</p> <p>Recommended Reading: [1].</p> <p>SRS: Processing of lecture materials</p>
16	<p>The wheel is geared.</p> <p>Calculation of gear parameters.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ;</p> <p>Recommended Reading: [7].</p> <p>SRS: Processing of lecture materials</p>
17	<p>Projection conversion methods.</p> <p>Methods of plane-parallel movement and rotation around the level line.</p> <p>Didactic aids: <a href="http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf">http://ng-kg.kpi.ua/files/Tetrad2012_20_4_protected.pdf</a> ;</p> <p>Recommended reading: [1], [4].</p> <p>SRS: Processing of lecture materials</p>
18	<p>Passed. Performance of test work according to options.</p>

### Practical classes

No Salary	Title of the topic of the lesson and a list of the main questions (list of didactic support, links to literature and tasks for the SRS)
1	<p><b><u>Point projection. Species</u></b></p> <p>Construction of Three Model Projections by Variants</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p>A projection drawing of a wooden model is being made: views.</p> <p><b>Recommended reading:</b> [2], [4], [5].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic.</p>
2	<p><b><u>Images, views, sections, sections.</u></b></p> <p>A projection drawing of a wooden model is performed: the sections are simple, the combination of the view and the section. Dimensioning. Drawing design.</p> <p><b>Didactic aids:</b> reference tables, methodical maps, wooden models.</p> <p><b>Recommended reading:</b> [2], [4], [5].</p> <p><b>CPC:</b> Execution of a projection drawing of a wooden model (A3 format).</p>

№ Salary	Title of the topic of the lesson and a list of the main questions (list of didactic support, links to literature and tasks for the SRS)
3	<p><b><u>Line modeling. Method of replacing projection planes.</u></b> Complex drawing of a straight line. Straight levels and projections, their properties. Determination of the natural size of a segment of a straight line of general position by replacing the planes of projections. The first and second typical tasks. PKR1 "Point, Straight Line".</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p><b>Recommended reading:</b> [1], [4].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic.</p>
4	<p><b><u>Plane modeling. A projection of a circle that belongs to a plane.</u></b> The problems of constructing the belonging of a line and a point to a plane are considered; conversion of the plane of general position into projection and level; projection of a circle, which is located in the planes of special and general position. PKR2 "Plane".</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p><b>Recommended reading:</b> [1], [4].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic. Execution of a diagram (A3 format).</p>
5.	<p><b><u>The incisions are complex.</u></b> A projection drawing of the part is performed: complex sections, alignment of the view and section. Dimensioning. Drawing design.</p> <p><b>Didactic aids:</b> reference tables, methodical maps, wooden models.</p> <p><b>Recommended reading:</b> [2], [4], [5].</p> <p><b>CPC:</b> Execution of a projection drawing of a part (A3 format).</p>
7	<p><b><u>Curved lines and surfaces. Plotting points and lines on surfaces.</u></b> A general technique for constructing points and lines on surfaces. Four types of point-building problems. Build a line on a surface (shape).</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p><b>Recommended Reading:</b> [1].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic.</p>
8	<p><b><u>Working drawings and sketches of parts. Slicing. Images and notations of the thread on the drawing. Threaded part.</u></b> Slicing. Image and notation of the thread on the drawing. Threaded part (union nut). Surface roughness. Materials. Anti-ship missile 7 "Rifling". Execution of a sketch in detail according to the variants based on the elaboration of the theoretical material of the lecture.</p> <p><b><u>Verification of works. First certification!</u></b></p> <p><b>Didactic aids:</b> reference tables, methodical maps.</p> <p><b>Recommended Reading:</b> [3], [7].</p> <p><b>SRS:</b> Execution of a working drawing of a part of the "Cap nut" type. (A3 format).</p>
9	<p><b><u>Working drawings and sketches of parts of the "Shaft" type.</u></b> Features of the execution of sketches of parts of the "Shaft" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Shaft" type. Construction of sections. Anti-ship missile 8 "Val"</p> <p><b>Didactic aids:</b> reference tables, methodical maps.</p> <p><b>Recommended Reading:</b> [3], [7].</p> <p><b>CPC:</b> Execution of a working drawing of a part of the "Shaft" type (A3 format).</p>
10	<p><b><u>Intersection of surfaces with a plane.</u></b> A general technique for crossing surfaces with a plane. Four types of problems for the intersection of surfaces by a plane. Construction of a line (figure) of intersection of second-order surfaces by planes of separate and general position.</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p>

№ Salary	Title of the topic of the lesson and a list of the main questions (list of didactic support, links to literature and tasks for the SRS)
	<p><b>Recommended Reading:</b> [1].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic.</p>
11	<p><b><u>Sweep.</u></b></p> <p>General method of constructing scans. Construction methods. Verification of works.</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p><b>Recommended Reading:</b> [1].</p> <p><b>CPC:</b> Preparation for the graphic work "Sweep" (A3 format).</p>
12	<p><b><u>Working drawings and sketches of parts of the "Cover" type.</u></b></p> <p>Features of sketching parts of the "Cover" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Cover" type.</p> <p><b>Didactic aids:</b> reference tables, methodical maps.</p> <p><b>Recommended Reading:</b> [3], [7].</p> <p><b>CPC:</b> Execution of a working drawing of a part of the "Cover" type (A3 format).</p>
13	<p><b>SRS:</b> Processing of lecture materials.</p> <p><b><u>Working drawings and sketches of parts of the "Hull" type.</u></b></p> <p>Features of sketches of parts of the "Body" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Body" type.</p> <p><b>Didactic aids:</b> reference tables, methodical maps.</p> <p><b>Recommended Reading:</b> [3], [7].</p> <p><b>SRS:</b> Execution of a working drawing of a part of the "Body" type (A3 format).</p>
14	<p><b><u>Verification of works. Second certification!</u></b></p>
15	<p><b><u>Intersection of surfaces.</u></b></p> <p>Problems are performed to build lines of intersection of two second-order surfaces using intermediaries.</p> <p><b>Didactic aids:</b> Workbook (theoretical information on the topic of the lecture and conditions for home exercises and classroom tasks).</p> <p><b>Recommended Reading:</b> [1].</p> <p><b>CPC:</b> Doing homework in a workbook on a given topic.</p> <p><b><u>Working drawings and sketches of parts of the "Hull" type.</u></b></p> <p>Features of sketches of parts of the "Body" type. Structural and technological elements of parts. General rules for applying dimensions. Sketch of a part of the "Body" type.</p> <p><b>Didactic aids:</b> reference tables, methodical maps.</p> <p><b>Recommended Reading:</b> [3], [7].</p> <p><b>SRS:</b> Execution of a working drawing of a part of the "Body" type (A3 format).</p>
16	<p><b><u>The joints are threaded, the joints are one-piece.</u></b> Types of standard threaded products. Standards, sizes and purpose of standard products.</p> <p>Features of the execution of threaded connections. Types of standard one-piece products. Welding, soldering, adhesive bonding. Standards, sizes and purpose of standard products.</p> <p>Assembly drawing.</p> <p>Registration of the specification.</p> <p><b>Didactic aids:</b> <a href="http://ng-kg.kpi.ua/files/development-w-drawings.pdf">http://ng-kg.kpi.ua/files/development-w-drawings.pdf</a></p> <p><b>Recommended Reading:</b>[6].</p> <p><b>CPC:</b> Execution of the drawing "Connection" (A3 format).</p>
17	<p><b><u>The wheel is geared.</u></b></p> <p>Execution of the drawing "Gear wheel" (A3 format). Verification of works.</p> <p><b>SRS:</b> Processing of lecture materials. Preparation for the test.</p>
18	<p><b><u>Passed.</u></b></p>



## 6. Student's independent work

The hours allotted for the student's independent work are specified in paragraph 5. Methods of mastering the discipline are doing homework, preparing for work in practical classes; performance of calculation and graphic work, as well as preparation for modular control work and credit.

### Policy & Control

## 7. Academic discipline policy (educational component)

The study of the discipline "Engineering and Computer Graphics" requires from the applicant for higher education:

- compliance with educational and academic ethics, more details: <https://kpi.ua/code> ;
- compliance with the schedule of the educational process;
- be balanced, attentive in the classroom;
- systematically process theoretical material;
- compliance with the schedule for the protection of calculation and graphic work. The applicant's answer must demonstrate signs of independence in the performance of the task, the absence of signs of repetition and plagiarism.

If a higher education applicant was absent from a lecture, then he/she should process this lecture at another time (with another group, at a consultation, independently, using methodological materials posted on the Sikorsky distance learning platform, video recordings, etc.).

If the higher education applicant was absent from the practical lesson, then he should work out the material of this practical lesson at another time (with another group, at a consultation, independently, using methodological materials posted on the Sikorsky distance learning platform, videos, etc.).

## 8. Types of control and rating system for assessing learning outcomes (CRO)

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

1. A student's rating in a credit module consists of the points that he/she receives for:

- classroom and homework on the topic of the lecture in the workbook (7 tasks);
- programmable control (6 tasks);
- implementation of modular control work of the MCR;
- execution and defense of 9 graphic tasks;
- execution and protection of computational and graphic work (WGR).

2. Criteria for awarding points:

2.1. Completion of tasks in the workbook is estimated at 2 points according to the following criteria:

- flawlessly done work, excellent graphics, timely delivered work – 2 points;
- there are certain shortcomings in execution, good graphics, violation of the delivery schedule up to 2-3 weeks - 1.6 points;
- there are significant deficiencies in performance, satisfactory graphics, late delivery of work – 1.2 points;

2.2. Programmable control (6 tasks);

- flawlessly performed work – 2 points;
- there are certain shortcomings in performance – 1.6 points;
- there are significant shortcomings in performance – 1.2 points;

2.3. Performance of modular control work is estimated at 10 points:

- flawlessly done work - 10 points;
- insignificant deficiencies in the performance of work - 8 points;
- significant deficiencies in the performance of work - 6 points;

- The work is done incorrectly or not at all - 0 points.

2.4. Performance and defense of graphic tasks are estimated at 5 points:

- flawlessly done work, excellent graphics – 5 points;
- there are certain shortcomings in execution, good graphics, violation of the delivery schedule up to 2-3 weeks - 4 points;
- there are significant shortcomings in performance, satisfactory graphics – 3 points;

2.5. Performance of calculation and graphic work is estimated at 19 points:

- flawlessly performed work - 19 points;
- there are not significant deficiencies in the performance of work - 16 points;
- there are significant deficiencies in the performance of work – 11.4 points;
- The work is done incorrectly or not at all - 0 points.

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

The condition for the first calendar control is to receive at least 16 points and perform and defend four topics in the workbook, three graphic works, and receive a positive mark from four programmable tests. The condition for the second calendar control is to receive at least 47 points and to complete and defend seven topics in a notebook, eight graphic works, and receive a positive mark from six programmable tests. The condition for obtaining a credit is the performance and defense of calculation and graphic work, tasks in the workbook on 7 topics of the course, 9 graphic works, obtaining positive marks from 6 programmable tests and modular control work.

**Total points:**

- classroom and homework on the topic of the lecture in the workbook,  $7 \times 2$  points = 14 points;
- programmable control,  $6 \times 2$  points = 12 points;
- performance of modular control work, 10 points;
- performance and defense of graphic tasks,  $9 \times 5$  points = 45 points;
- performance and defense of calculation and graphic work, 19 points.

Total: 100 points.

With applicants who have fulfilled all the conditions for admission to the test and have a rating score of less than 60 points, as well as with those applicants who want to increase their rating grade, at the last lesson in the discipline in the semester, the teacher conducts semester control in the form of a test work.

In this case, the points obtained for Execution and defense of graphic tasks, execution and defense of calculation and graphic work remain, and points received for modular control work, classroom and homework on the topic of the lecture in the workbook and programmable control are canceled.

Passing the test takes place on tickets. The ticket consists of two tasks. The condition of the first task includes the educational material that is studied in the first theoretical part of the course. Knowledge of projection methods and methods of simplifying the solution of course problems is tested. The second task is complex. The acquired competencies of modeling geometric objects, the ability to apply the requirements of standards in the design of design documentation are checked.

The maximum number of points received for the test is 36 points:

The criterion of credit evaluation is determined as the sum of the quality of answers to the tasks of the ticket according to the table.

**Number of points for the ticket task**

<b>Points</b>	<b>Evaluation criterion</b>
34-36	Excellent answer (at least 95% of the information), possible minor comments and inaccuracies
31-33	Very good answer (at least 85% of the information), no mistakes, answer to the vast majority of questions, creative thinking

27-30	Good answer (at least 75% of information), no errors, answer to most questions, some shortcomings
23-26	Satisfactory answer (at least 65% of the information) is a remark, an answer to some of the questions
21-22	Sufficient answer (at least 60% of information), significant errors, answers to certain questions.
0,0	The answer is incorrect or less than 60% of the information, or it is missing

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

**Work program of the discipline (syllabus):**

**Compiled by:** Associate Professor of the Department of Descriptive Geometry, Engineering and Computer Graphics

Ph.D. Zalevsky S.V.

Senior Lecturer at the Department of Descriptive Geometry, Engineering and Computer Graphics

Ovsienko L.G.

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