



ENGINEERING GRAPHICS

The Working Program of the Academic Discipline (Syllabus)

The requisites of the Academic Discipline

Level of higher education	<i>The first (bachelor's degree)</i>
Subject area	14 Electrical Engineering
Specialty	142 Power Engineering
Educational program	Engineering and Computer Technology of Thermal Power System
The status of the discipline	Normative
The form of studying	Full-time / distance / blended
The year of studying, term	The 1 st year, autumn / spring term
Discipline's workload	7,5 ECTS credits (225 hours)
Term control / Control measures	Autumn term – an exam, a spring one – a credit
Timetable	Autumn term: lecture – 1 time per week (36 hours); practical lessons – 1 time per week (36 hours); laboratory lesson – 1 time per 2 weeks (18 hours) Spring term: practical lessons – 1 time per week (36 hours) http://rozklad.kpi.ua/
Language of instruction	Ukrainian
The information on the course leader / teachers	Department of Descriptive Geometry, Engineering and Computer Graphics (building 7, room 815), e-mail: geometry@kpi.ua Telephone number: +380 44 204 94 46 Lecturer: Senior Teacher Hanna Shepel, shepel.hanna.s@gmail.com , +3 8093 032 12 54 Practical lessons: Senior Teacher Hanna Shepel, shepel.hanna.s@gmail.com , +3 8093 032 12 54
Course Placement	https://do.ipk.kpi.ua/course/view.php?id=685 https://do.ipk.kpi.ua/course/view.php?id=4517

The Program of the Academic Discipline

1. The Description of the Academic Discipline, its Objectives, subject of the study and Learning Outcomes

The main objective of the discipline is forming the competencies of basic knowledge system on the main units of the course, obtaining the experience and applying the methods of spatial forms geometric modelling, creating and arranging design documentation considering requirements of standards.

The syllabus makes students apply the skills and knowledge gained in the previous units to complete the next one. Special attention is paid to the principle of encouraging students' active learning. Organizing students' independent work with the help of methodological guidelines complexes (including lecture presentations and video lessons on solving the most important problems of each topic), that are posted on distance learning platform Sikorsky. These materials have proven to be effective in distance learning. The students have to solve practical problems that will enable them to solve real problems in professional activity. These are applied while teaching:

- Active and group learning strategies;
- Personally-oriented developing technologies based on active forms and methods of teaching (team-based learning, independent work and independent learning particular topics).

As a result of studying Descriptive Geometry discipline students obtain the following competencies:

General:

1. The ability to exercise one's rights and obligations as a member of society realizing the values of civil (free and democratic) society and the necessity of its sustainable development, rule of law, human and civil rights and liberties in Ukraine (3K 1);
2. The ability to preserve and multiply ethical, cultural, scientific values and achievements of the society based on understanding the subject history and patterns of development, its position in the general nature and society and technology knowledge system and development, to use various types of physical exercise for active rest and leading a healthy lifestyle (3K 2);
3. The ability to learn and obtain modern knowledge (3K 3);
4. The ability to implement the knowledge in emergency situations (3K 4);
5. To have the skills of using information and communication technologies (3K 5);
6. The ability to work on a team (3K 6);
7. The ability to search, process and analyse the information from various sources (3K 7);
8. The ability to communicate in the state language both orally and in written form (3K 8).

Professional:

1. The ability to search and analyse information, conduct patent search in addition to using scientific and technical literature, databases and other sources of information for carrying out professional activity (ΦK 4);
2. The ability to implement standard methods for units of power and technological equipment calculations (ΦK 5);
3. The ability to investigate and identify the problem and limitations including those that are connected to law, nature preservation, sustainable development, health, safety and risk assessment in nuclear energy field (ΦK 7);
4. The ability to consider legal, social, environmental, ethical, economical and commercial aspects that influence the exercising of engineering solutions in nuclear energy field (ΦK 8);
5. The ability to consider the broader interdisciplinary engineering context in professional activity (ΦK 9).

Program learning outcomes:

1. The knowledge and understanding mathematics, physics, chemistry and engineering science at the level necessary achieving the results of the educational program (including particular awareness of recent advances in the field) (IPPH 1);
2. The implementation of physical, mathematical and computer modelling for the purpose of detailed learning and investigation of issues in at least one of nuclear energy directions (IPPH 9);
3. The knowledge and understanding of the main features, scope of application and limitations of the equipment, materials and tools, engineering technologies and processes used for solving professional problems (IPPH 12);

4. *The knowledge and understanding of the main features, scope of application and limitations of the equipment, materials and tools, engineering technologies and processes used for solving professional problems (IIPH 12);*
5. *The developed skills of independent learning (IIPH 19).*

The above competencies and program outcomes of Engineering graphics discipline are achieved due to students' knowledge of:

- *Descriptive geometry and engineering graphics basics;*
- *The geometric modelling of spatial shapes on a plane basics;*
- *The methods of design documentation development in accordance with requirements of standards*

2. Pre-requisites and Post-requisites of the Discipline (its Place in structural and logical scheme of studying in accordance with corresponding educational program)

The discipline lays the foundations for studying other disciplines: Information Technology, Higher Mathematics, course and Diploma Design and the disciplines that involve creating and arranging traditional projection and electronic drawings with the help of modern CAD, geometric and computer 3D-modelling of the heat and power equipment. These disciplines are included in the cycle of students' professional and practical training.

3. The Content of Engineering Graphics Discipline.

Credit module 1. Engineering graphics.

Module 1. Plane and Surface projection

Topic 1.1. **Introduction. Point projection.** The subject and tasks of the course, its position in the complex of engineering training for bachelors and masters in thermal power engineering. The methods of projection. Perspective and parallel projection. Point projection. Point multidrawing. The methods of the third point projection drawing. Point position according to plane projections. Direct and inverse problems.

Topic 1.2. **Straight line projection. The method of projection plane replacement.** Sketching a straight line on the drawing. Special position lines: level and projection ones. General position line. Point located on the line. The division of a line segment in a given ratio. The method of projection plane replacement. Main problems of the method of projection plane replacement using the example of straight-line segment of general position. The relative position of two straight lines.

Topic 1.3. **Plane projection.** Sketching a plane of the drawing. Special position planes: level and projection ones. Trace plane of special position. Planes of general position. Straight line and point location on the plane. Determination of the natural size of a flat shape. Parallel planes. The intersection of special position planes. The intersection of general and special position planes. Curves. Circle projection.

Topic 1.4. **Surfaces and curves.** Methods of specifying surfaces, their definition, classification. Expandable and non-expandable ruled surfaces. Surfaces of revolution. Dot and line construction on a surface, the conditions of their location on the plane.

Topic 1.5. **Axonometric projections.**

General information on perspective geometry. Coefficient of distortion. Classification. Drawing rectangular axonometric projections.

Module 2. Drawing an intersecting line of a plane and surfaces.

Topic 2.1. **Intersection of surfaces by a plane.** The general technique for intersecting surfaces with a plane. Drawing a line (a shape) of intersecting the second order surfaces with special position planes. Finding the actual size of intersecting shape.

Topic 2.2. **The developed view of engineering surfaces.**

The developed view definition. The main methods of drawing a developed view. Drawing cylinder and cone planes developed views. Assumed developed views of non-expandable surfaces (spheres, conoids etc.) Geodetic line and its drawing. The examples of drawing developed views in production and technology.

Topic 2.3. **Single and double penetration construction**

Single and double penetration. The common method of solving single and double plane penetration problems with the help of symmetric and asymmetric horizontal "windows".

Module 3. Constructing an intersecting plane line of complex engineering shapes

Topic 3.1. **Plane intersection.**

The classification of possible cases. General algorithm for constructing points of intersection. Special cases of plane intersection, using intermediaries – separate position planes. Method of spherical intermediaries. Monge's theorem. Special cases. Conclusions.

Module 4. Types and rules for the design of engineering drawings.

Topic 4.1. **The United System for Design Documentation (ЕСКД) – the main principles.**

Formats. Scale. Lines. Fonts. Geometric drawing. Conjugation of geometric elements. Basic requirements for dimensioning a drawing.

Topic 4.2. **Projection drawing**

Basic images. Views, sections, intersections. Classification of sections. Simple sections; horizontal, vertical, oblique. Complicated sections: offset, broken-out and combined. The peculiarities of their drawing. The main provisions of the GOST 2.305-68 standard: Application of dimensions.

Topic 4.3. **Sketches and working drawings of details.**

Thread. Classification of threads. Drawing and designation of a thread on the drawing. A detail with a thread. Roughness of detail surface. Surface roughness parameters. Conventions for marking roughness on drawings. "Shaft" detail

Module 5. Threaded and integral connections

Topic 5.1. **Structural elements of assembly units. Threaded connections.**

Connection with the help of screws, pins and bolts. Calculation of lengths of fasteners.

Compilation of conditional designations.

Compilation of the specification for the assembly unit. Compilation of conditional designations for fasteners.

Topic 5.2. **Integral connections.**

Connection by welding, soldering and gluing. Designation of welding, soldering and gluing.

Credit module 2. Engineering drawing.

Module 1. Execution of an assembly drawing from nature

Topic 1.1. **Sketching the assembly unit details**

The peculiarities of sketching foundry details. Working with a reference book for depicting structural

and technological elements of details. Dimensioning. Surface roughness parameters and detail material designation.

Topic 1.2. **Assembly drawing**

Purpose, features of the image of the assembly unit, conventions and simplifications recommended by the standards for use on assembly drawings. Position numbers, their location. Dimensioning an assembly drawing. Technical requirements. Sketching the assembly unit.

Topic 1.3. **Compilation of the assembly unit specification**

Module 2. General view drawings reading and detailing

Topic 2.1. **General view drawings reading**

Purpose, features and principles of execution and designation of general view drawings.

Topic 2.2. **Detailing according to the general view drawing**

The peculiarities of general view drawing detailing. The detail shape designation due to its image on the general view drawing. The analysis of its connection with other details. Choosing the main view, quantity and type of images on the drawing.

Dimensioning considering technological and datum surface. Detail surface roughness designation due to general view drawings.

4. Training materials and resources

Core reading

1. Vanin V.V, Perevertun V.V, Nadkernychna T.M. ta in. Inzhenerna ta komp'uterna hrafika. K.: Vyd.hr.BHV, 2009. — 400 s.
2. Inzhenerna hrafika: pidruchnyk dlia studentiv vyshchych zakladiv osvity I - II rivniv akredytatsii/ V.Ie.Mykhailenko, V.V.Vanin, S.M.Kovalov; Za red. V.Ie.Mykhailenka. -Lviv: Picha Yu.V.; K.: Karavela; Lviv: Novyi svit - 2000. – 284 s.
3. Vanin V.V.,Bliok A.V.,Hnitetska H.O. Oformlennia konstruktorskoï dokumentatsii: Navch.posib. 3-ye vyd.-K.: Karavela, 2012.-200 s.
http://geometry.kpi.ua/files/Vanin_Gniteckaja_kd1_2.pdf
4. V.V. Vanin, N.V. Bilytska, O.H. Hetman, N.V. Mikhlevska. Narysna heometriia ta inzhenerna hrafika. Navchalni zavdannia dlia prohramovanoho navchannia. Navchalnyi posibnyk dlia studentiv nemekhanichnykh spetsialnostei. - K.: NTUU “KPI”, 2020. — 69 s.

Additional reading

5. Mykhailenko V.Ie., Vanin V.V., Kovalov S.M. Inzhenerna ta kompiuterna hrafika. — K.: Karavela, 2012. — 363 s.
6. Khaskin A.M. Kreslennia. — K.: Vyshcha shk., 1985. — 440 s.
7. Tekhnichne kreslennia. Teoretychni vidomosti ta zavidannia z detaliuvannia kreslenykyv zahalnoho vydu. [Elektronnyi resurs]: navch. posib. dlia zdobuvachiv stupenia bakalavra za spetsialnostiamy 142 «Enerhetychne mashynobuduvannia», 143 «Atomna enerhetyka» ta 144 «Teploenerhetyka» /KPI im. Ihoria Sikorskoho; uklad.: P.M.Iablonskyi, O.H.Hetman, N.V.Bilytska, H.V.Baskova.– Elektronni tekstovi danni (1 fail: 12,24 Mbait). – Kyiv: KPI im. Ihoria Sikorskoho, 2022. – 174 s.
8. INZhENERNA HRAFIKA. Rozdil: Narysna heometriia. Kurs leksii dlia dystantsiinoho rezhymu navchannia [Elektronnyi resurs]: navch. posib. dlia stud. spetsialnostei 142 «Enerhetychne mashynobuduvannia», 143 «Atomna enerhetyka», 144 «Teploenerhetyka» /N.V. Bilytska, O.H. Hetman; KPI im. Ihoria Sikorskoho.–Elektronni tekstovi dani (1 file: 39,6 MB). – Kyiv: KPI im. Ihoria Sikorskoho, 2021. – 171 s.
<https://ela.kpi.ua/handle/123456789/39819>
9. INZhENERNA HRAFIKA. Rozdil: Proieksiine kreslennia. Kurs leksii dlia dystantsiinoho rezhymu navchannia [Elektronnyi resurs]: navch. posib. dlia stud. spetsialnostei 142 «Enerhetychne mashynobuduvannia», 143 «Atomna enerhetyka», 144 «Teploenerhetyka»,

- spetsializatsii «Teplofizyka» /N.V. Bilytska, O.H. Hetman; KPI im. Ihoria Sikorskoho.–Elektronni tekstovi dani (1 file: 13,6 MB). – Kyiv: KPI im. Ihoria Sikorskoho, 2021. – 72 s.
<https://ela.kpi.ua/handle/123456789/39822>
10. INZhENERNA HRAFIKA. Rozdil: Mashynobudivne kreslennia. Kurs lektzii dlia dystantsiinoho rehymu navchannia [Elektronnyi resurs]: navch. posib. dlia stud. spetsialnostei 142 «Enerhetychne mashynobuduvannia», 143 «Atomna enerhetyka», 144
11. «Teploenerhetyka» /N.V. Bilytska, O.H. Hetman; KPI im. Ihoria Sikorskoho.–Elektronni tekstovi dani (1 file: 19,7 MB). – Kyiv: KPI im. Ihoria Sikorskoho, 2021.
<https://ela.kpi.ua/handle/123456789/39823>

All this literature is in sufficient amount in the Scientific and Technical Library of the Igor Sikorsky Kyiv Polytechnic Institute.

Information resource

1. Complex of teaching materials. Distance learning platform “Sikorsky”:
<https://do.ipk.kpi.ua/course/view.php?id=685>
2. Complex of teaching materials. Distance learning platform “Sikorsky”:
<https://do.ipk.kpi.ua/course/view.php?id=4517>
3. Scientific and Technical Library of the Igor Sikorsky Kyiv Polytechnic Institute
<ftp://77.47.180.135/>
4. Methodological documentation of the site of the department:
http://ng-kq.kpi.ua/index.php?option=com_content&view=article&id=37:2010-06-05-04-40-02&catid=71:narisnauch1&Itemid=13

Training content

5. Methods of mastering the discipline (educational component)

The curriculum of the discipline provides for lectures and practical lessons. Methodological support is using information resource which contains methodological complex of guidelines: lecture course with each lecture presentation and a link to a relevant textbook unit, video lessons on solving the most important problems of each topic, problem variants and methodological instructions on their solving which can be found on learning platform “Sikorsky” and Google Classroom. In case of distance learning all these materials can be used during lectures and practical lessons via Zoom or other platforms. They can also be accessible in organizing students’ individual work within the framework of remote access to information resources at a time convenient for them.

Credit Module 1. Engineering graphics.

Lectures

#	Topics of lectures
1	<i>Introduction. Point projection.</i> The subject and tasks of the course. Its position in the complex of engineering training for bachelors and masters in thermal power engineering. Point multidrawing. The methods of the third point projection drawing. Point position according to plane projections. Direct and inverse problems. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588

	Recommended reading: [1], unit.2, p.55,56,60; unit. 5, p.145. Students' individual work: Doing homework on the given topic in the course workbook
2	Straight line complex drawing. Level and projection lines, their peculiarities. Finding the actual size of general position line segment using the method of projection plane replacement. The first and second typical problems. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=51645 Recommended reading: [1], unit.2, p.55,56,60, [4] p.7-11. Students' individual work: Doing homework on the given topic in the course workbook
3	Plane and circle projections. Constructing a plane on the drawing. Special position planes: level and projection ones. Trace plane of special position. Planes of general position. Zero traces of planes. A point and a straight line belonging to a plane. Transforming a general position plane into level and projection ones. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 [5] p.13-16 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=54790 Recommended reading: [1], unit 2, p.65, [4] p.12-16. Students' individual work: Doing homework on the given topic in the course workbook
4	Curves and surfaces. Classification of curves. Methods of drawing surfaces, their classification, determinants of surfaces. Surfaces of revolution. Constructing points and lines on surfaces. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 [5] p.13-16. https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=56185 Recommended reading: [1], unit 7, p.212, [4] p.17-20. Students' individual work: Doing homework on the given topic in the course workbook
5	Axonometric projections. Types of perspective geometry. Axonometric projection of a point. Rectangular isometry and dimetry. Coefficient of distortion. Constructing a circle in perspective geometry. Methods of constructing ellipses. Axonometric image of a geometric model. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589

	https://do.ipk.kpi.ua/mod/resource/view.php?id=56997 Recommended reading: [1], unit 9, p.271, [4] p.21-27. Students' individual work: Doing homework on the given topic in the course workbook
6	Intersection of surfaces by a plane. The general technique for intersecting surfaces with a plane. Four types of problems on intersecting of surfaces with planes. Drawing a line (a shape) of intersecting the second order surfaces with special position planes. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/resource/view.php?id=58316 Recommended reading: [1], unit.9, p.271, [4] p.28-32. Students' individual work: Doing homework on the given topic in the course workbook
7	The developed views of engineering surfaces. The developed view definition. The main methods of drawing a developed view. Drawing cylinder and cone planes developed views. Assumed developed views of non-expandable surfaces (spheres, conoids etc.) Geodetic line and its drawing. The examples of drawing developed views in production and technology. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 Recommended reading: [1], unit.9, p.271, [4] p.32-33. Students' individual work: Doing homework on the given topic in the course workbook
8	Single penetration of surfaces. Views and sections on drawings. The common method of solving single plane penetration problems. Basic provisions of the standards DSTU/GOST State Standards of Ukraine (Derzhavni Standarty Ukrainy). Dimensioning. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Recommended reading: [1], unit.10, p.288, [4] p.34-36. Students' individual work: Doing homework on the given topic in the course workbook
9	Double surface penetration. Views and sections on drawings. The common method of solving single and double plane penetration problems Basic provisions of the standard GOST (National standard-setting authority) 2.305-68. Examples of tasks. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61974 https://do.ipk.kpi.ua/mod/resource/view.php?id=61973 http://ela.kpi.ua/handle/123456789/6764

	Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=43035. Recommended reading: [1], unit.10, p.288, [4] p.36-38. Students' individual work: Doing homework on the given topic in the course workbook
10	Surface intersection. Classification of possible cases. General algorithm for constructing points of intersection. Special cases of plane intersection Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=63210 http://ela.kpi.ua/handle/123456789\6764 https://do.ipk.kpi.ua/mod/url/view.php?id=27263 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=43035. Recommended reading: [1], unit.10, p.294, [4] p.39-40. Students' individual work: Doing homework on the given topic in the course workbook
11	Surface intersection. Special cases of plane intersection, using intermediaries – separate position planes, spheres. Monge's theorem. Conclusions of Monge's theorem. Special cases of plane intersection, using intermediaries – spheres with variable centres Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=63210 http://ela.kpi.ua/handle/123456789\6764 https://do.ipk.kpi.ua/mod/url/view.php?id=27263 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=43035. Recommended reading: [1], unit.10, p.294, [4] p.41-43. Students' individual work: Doing homework on the given topic in the course workbook
12	<i>The United System for Design Documentation (ЄСКД) – the main principles</i> Introduction. The general rules for drawing designs. The United System for Design Documentation ЄСКД. Formats, scales, lines, fonts, dimensioning. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Reference tables, methodical cards, samples of work. Recommended reading: [3], GOST 2.301-68.-GOST 2.304-80, GOST 2.307-68 Students' individual work: Working on the lecture materials. Drawing flat details.
13	Images: views, sections. Dimensioning. General principles for drawing geometrical forms considering the standards. Peculiarities of drawing external and internal forms of geometric models. Applying views and sections. Concept, purpose, classification, peculiarities of location and designation on drawings. The principles of choosing the view and quantity of necessary images on the drawing. Choosing the main view. Combining the part of the view and section. Conventions and simplifications when performing images. Dimensioning. Dimensions of position and shape. Samples of solving. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=54850 https://is.qd/d9AdiA https://do.ipk.kpi.ua/mod/resource/view.php?id=55415 Reference tables, methodical cards, samples of work, wooden models. Recommended reading: [3], GOST 2.305-68.

	Students' individual work: Working on the lecture materials. Drawing the wooden model projection
14	Images: views, complex sections. Definition, designation, classification. The peculiarities of drawing offset and broken-out sections, their position and designation on drawings. Dimensioning. Datum surfaces definition. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=54850 https://is.gd/d9AdiA https://do.ipk.kpi.ua/mod/resource/view.php?id=56998 Reference tables, methodical cards, task cards, samples of work. Recommended reading: [3], GOST 2.305-68. Students' individual work: Working on the lecture materials. Drawing the model projection specified in 2 views.
15	Thread and its classification. Structural and technological elements of details. Thread, its purpose. Classification of threads. The image and designation of the thread on drawings Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61976 https://is.gd/d9AdiA Reference tables, methodical cards, details. Recommended reading: [3, 7], unit.3, 4, 5, p.26-78. Students' individual work: Working on the lecture materials
16	Sketches and working drawings of details. "Hexagonal nut" detail. General requirements for working drawings of details. Sketching: stages of development. Sequence of execution of sketches. Designation of materials and surface roughness on sketches and drawings. Structural and technological elements of details. General rules for dimensioning. "Hexagonal nut" detail sketching. Drawing the intersection curve of chamfer and hexagonal part of nut surfaces. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61976 https://is.gd/d9AdiA Reference tables, methodical cards, task cards, samples of work, details according to variants. Recommended reading: [1], unit 10, p.294. Students' individual work: Working on the lecture materials, detail with a thread drawing
17	Sketches and working drawings of details. "Shaft" detail. Peculiarities of drawing "Shaft" details. Structural and technological elements of details. General rules for dimensioning. "Shaft" detail sketching constructing sections. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=75496 https://is.gd/d9AdiA Reference tables, methodical cards, task cards, samples of work, details according to variants. Recommended reading: [1], unit.9, p.271. Students' individual work: Working on the lecture materials, "Shaft" detail sketching.
18	Revision lecture. Exam preparation.

	Didactic resources: Reference tables, methodical cards, course workbook. Recommended reading: [1], [4]. Students' individual work: Working on the lecture materials
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Practical lessons

Name of a practical lesson and key issues	Academic hours
<u>Practical lesson 1</u> Introduction. Point projection. Problems of constructing points, points position according to projection planes and geometric elements of shapes are considered. Didactic resources: http://ela.kpi.ua/handle/123456789\6764 https://do.ipokpi.ua/mod/url/view.php?id=43035 Course workbook https://do.ipokpi.ua/mod/resource/view.php?id=51644 Recommended reading: [1], unit 2, p.55,56,60. Students' individual work: Doing homework on the given topic in the course workbook p.10 #1,2.	2
<u>Practical lesson 2.</u> Straight line projection Problems of straight-line complex drawing; finding the actual size of general position line segment using the method of projection plane replacement; constructing space geometric shapes are considered. Didactic resources: Course workbook https://do.ipokpi.ua/mod/url/view.php?id=90590 https://do.ipokpi.ua/mod/url/view.php?id=90588 https://do.ipokpi.ua/mod/resource/view.php?id=51645 https://do.ipokpi.ua/mod/url/view.php?id=54837 https://do.ipokpi.ua/mod/url/view.php?id=54838 https://do.ipokpi.ua/mod/url/view.php?id=54839 Recommended reading: [1], unit 2, p.55, 56, 60. Students' individual work: Doing homework on the given topic in the course workbook p.10-12 #2-4, lesson exercises #5-7.	2
<u>Practical lesson 3.</u> Plane and circle projections. Problems of constructing a point and a straight line belonging to a plane; transforming a general position plane into level and projection ones; specific location circle projection and general location circle projections are considered. Didactic resources: Course workbook https://do.ipokpi.ua/mod/url/view.php?id=90590 [5] p.13-16. https://do.ipokpi.ua/mod/url/view.php?id=90588 https://do.ipokpi.ua/mod/url/view.php?id=90589 https://do.ipokpi.ua/mod/resource/view.php?id=54790 https://do.ipokpi.ua/mod/url/view.php?id=54841 https://do.ipokpi.ua/mod/url/view.php?id=54842	2

https://do.ipk.kpi.ua/mod/url/view.php?id=54844 https://do.ipk.kpi.ua/mod/url/view.php?id=54846 Recommended reading: [1], unit 2, p. 65. Students' individual work: Doing homework on the given topic in the course workbook p.17 # 8-11, lesson exercises p. 18 # 12-14 Doing an individual task of the first epure p. 49-50.	
<u>Practical lesson 4. Plane projection.</u> Tasks preparing for individual task of the first epure are performed. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 [5] p.13-16 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=56185 https://do.ipk.kpi.ua/mod/url/view.php?id=56995 https://do.ipk.kpi.ua/mod/url/view.php?id=56996 https://do.ipk.kpi.ua/mod/url/view.php?id=57000 https://do.ipk.kpi.ua/mod/url/view.php?id=57001 Course book (theoretical information on the topic of the lecture topic and conditions for individual tasks of the first epure). Recommended reading: [1], unit.2, p.65, [4] p.12-16. Students' individual work: Doing an individual task of the first epure p. 49-50.	2
<u>Practical lesson 5. Curves and surfaces.</u> Problems of constructing points and lines on surfaces of revolution are considered. Surface of revolution projections are drawn. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=56185 https://do.ipk.kpi.ua/mod/url/view.php?id=56995 https://do.ipk.kpi.ua/mod/url/view.php?id=56996 https://do.ipk.kpi.ua/mod/url/view.php?id=57000 https://do.ipk.kpi.ua/mod/url/view.php?id=57001 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises; individual tasks of the third epure). Recommended reading: [1], unit.7, p.212, [4] p.17-20. Students' individual work: Doing homework on the given topic in the course workbook p.22-23 # 15-16, lesson exercises p. 23-24 # 17-18.	2
<u>Practical lesson 6. Axonometric projections</u> Problems of constructing details in rectangular isometry and frontal oblique isometry are considered. Methods of constructing ellipses. Making sections and their hatching. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588	2

https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=56997 https://do.ipk.kpi.ua/mod/url/view.php?id=58314 https://do.ipk.kpi.ua/mod/url/view.php?id=58315 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises; individual tasks of the second epure). Recommended reading: [1], unit.9, p.271, [4] p.21-27. Students' individual work: Doing homework on the given topic in the course workbook p 30 # 19, 20, lesson exercises p. 31, # 21,22.	
<u>Practical lesson 7. Axonometric projections.</u> Tasks preparing for individual tasks of the second drawing are done. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook (individual tasks of the second epure). Recommended reading: [1], unit 9, p.271, [4] p.21-27. Students' individual work: Doing an individual task of the second epure p.51-52.	2
<u>Practical lesson 8. Intersection of surfaces by a plane. The developed views.</u> Problems of constructing the line (shape) of intersection of general and special position planes are done. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=58316 https://do.ipk.kpi.ua/mod/url/view.php?id=58314 https://do.ipk.kpi.ua/mod/url/view.php?id=58754 https://do.ipk.kpi.ua/mod/url/view.php?id=58756 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit.9, p.271, [4] p.28-32. Students' individual work: Doing homework on the given topic in the course workbook p.36. #23-26, lesson exercises p. 37 #26. Doing an individual task of the third epure p. 53-55.	2
<u>Practical lesson 9. Intersection of surfaces by a plane.</u> Tasks preparing for individual task of the first epure are performed. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/resource/view.php?id=58316 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 Recommended reading: [1], unit.9, p.271, [4] p.28-32.	2

Students' individual work: Doing an individual task of the third epure p. 53-56. <u>Practical lesson 10.</u> Developed views. Problems of constructing a developed view of the surface and finding the geodetic line are done. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit 9, p.271, [4] p.32-33. Students' individual work: Doing homework on the given topic in the course workbook p.36 #27.	2
<u>Practical lesson 11.</u> Single penetration construction. Views and intersections on drawings. Performed tasks for the construction of single penetration lines. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/resource/view.php?id=61974 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit 10, p.288, [4] p.36-38. Students' individual work: Doing homework on the given topic in the course workbook p.42. # 28. Doing an individual task of the fifth epure p. 60-62.	2
<u>Practical lesson 12.</u> Double penetration construction. Views and sections on drawings. General method for solving problems on double penetration of surfaces by symmetric and asymmetrical horizontal "windows". Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61974 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=64481 https://do.ipk.kpi.ua/mod/url/view.php?id=64482 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit 10, p.288, [4] p.36-38. Students' individual work: Doing homework on the given topic in the course workbook [5] p.42 # 29. Doing an individual task of the fifth epure p. 60-62.	2
<u>Practical lesson 13.</u> Double penetration construction. Individual tasks of the fifth epure are performed. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90588	2

https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 Course workbook (Individual tasks of the fifth epure). Recommended reading: [1], unit 10, p.288, [4] p.36-38. Students' individual work: Doing an individual task of the fifth epure p. 60-62.	
<u>Practical lesson 14.</u> Surface-to-surface intersection. Tasks are performed to construct lines of intersection between two second-order surfaces using intermediary planes. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 https://do.ipk.kpi.ua/mod/url/view.php?id=63641 https://do.ipk.kpi.ua/mod/url/view.php?id=63642 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit 10, p.294, [4] p.41-43. Students' individual work: Doing homework on the given topic in the course workbook p.47 # 30-31, and p. 48. # 32.	2
<u>Practical lesson 15.</u> Surface-to-surface intersection. Tasks are performed to construct lines of intersection between two second-order surfaces using intermediary planes. Specific instances of the intersection curve. Didactic resources: Course workbook https://do.ipk.kpi.ua/mod/url/view.php?id=90590 https://do.ipk.kpi.ua/mod/url/view.php?id=90588 https://do.ipk.kpi.ua/mod/url/view.php?id=90589 Course workbook (theoretical information on the lecture topic and conditions for home tasks and lesson exercises). Recommended reading: [1], unit 10, p.294, [4] p.41-43. Students' individual work: Doing homework on the given topic in the course workbook [5] p.48 # 32.	2
Topic 5.1. Threaded and integral connections. <u>Practical lesson 16.</u> Structural elements of assembly units. Threaded connections. Connection with the help of screws, pins and bolts. Calculation of lengths of fasteners. Compilation of conditional designations. Didactic resources: https://is.gd/dq1TPE ▪ reference tables, methodical cards, task cards, samples of work; ▪ methodological guidelines. Recommended reading: [4], p.228-247, p. 305-310. Students' individual work: Drawing the sketch of the threaded connections. Applying position numbers of the assembly details.	2
<u>Practical lesson 17.</u> Specification. Compilation of the specification for the assembly unit. Compilation of conditional designations for fasteners. Didactic resources:	2

https://is.gd/dq1TPE - reference tables, methodical cards, task cards, samples of work; - methodological guidelines. Recommended reading: [4], unit 23, p.379-380. Students' individual work: Completing the specification form.	
Practical lesson 18. Integral connections. Connection by welding, soldering and gluing. Designation of welding, soldering and gluing. Didactic resources: https://is.gd/CKBODI - reference tables, methodical cards, task cards, samples of work; - methodological guidelines. Recommended reading: [4], unit 21, p.328-343. Students' individual work: Drawing the sketch of the integral connections.	2

Laboratory lessons

Name of a laboratory lesson	Academic hours
Laboratory lesson 1. Introduction. General principles for designing drawings. Formats, scales, lines, fonts, dimensioning drawings. Didactic resources: https://do.ipokpi.ua/mod/url/view.php?id=90589 https://do.ipokpi.ua/mod/resource/view.php?id=51709 https://do.ipokpi.ua/mod/resource/view.php?id=51713 - reference tables, methodical cards, task cards, samples of work; - methodological guidelines. Recommended reading: [6], unit 1, p.13-20. Students' individual work: Learning algorithms for building drawings.	2
Laboratory lesson 2. General principles for designing drawings. Fillets. Classification of fillets. Algorithms of fillets drawing. Fillets. Classification of fillets. Algorithms of fillets drawing. Didactic resources: https://do.ipokpi.ua/mod/resource/view.php?id=51709 https://do.ipokpi.ua/mod/resource/view.php?id=51711 https://do.ipokpi.ua/mod/resource/view.php?id=51713 - reference tables, methodical cards, task cards, samples of work; - methodological guidelines. Recommended reading: [6], unit 2, 3, p.30-35, 44-62. Students' individual work: Learning algorithms for drawing fillets in graphic objects.	2
Laboratory lesson 3. Views. Sectional views Creating images based on model sketches according to variants. Drawing three basic views of models, representing their internal forms using dashed lines using different types of sectional views (such as half sections and broken-out sections). Didactic resources: https://do.ipokpi.ua/mod/resource/view.php?id=54850 https://do.ipokpi.ua/mod/resource/view.php?id=55415	2

https://do.ipk.kpi.ua/mod/resource/view.php?id=55399 ▪ reference tables, methodical cards, task cards, samples of work; ▪ methodological guidelines. Recommended reading: [3],[4], 6], unit 9, p.63-78, 79-81, 86-103. Students' individual work: Learning algorithms for drawing projection views, creation of sections.	
<u>Laboratory lesson 4.</u> Views. Straight sectional views. Measuring the model dimensions and drawing both external and internal geometric forms, including positional dimensions with the use of datum surfaces. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=54850 https://do.ipk.kpi.ua/mod/resource/view.php?id=55415 https://do.ipk.kpi.ua/mod/resource/view.php?id=55399 ▪ reference tables, methodical cards, task cards, samples of work; ▪ methodological guidelines. Recommended reading: [3],[6], unit 9, p.44-62, 63-81. Students' individual work: Dimensioning of the model sketch.	2
<u>Laboratory lesson 5.</u> Views. Multi-plane sectional views. Constructing the third view from two provided, performing a multi-plane section at the top view and a straight or multi-plane at other views. Dimensioning the model sketch. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=54850 https://do.ipk.kpi.ua/mod/resource/view.php?id=56998 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines. Recommended reading: [6], unit 8, p. 132-156. Students' individual work: Drawing a multi-plane section according to variants. Dimensioning the model.	2
<u>Laboratory lesson 6.</u> Construction and design of the projection drawing of a detail. Screw thread. Performing of the modular assessment. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61975 https://do.ipk.kpi.ua/mod/resource/view.php?id=54850 ▪ methodological guidelines. Recommended reading: [6], unit 2, p.36-40. Students' individual work: Construction and design of the projection drawing of a detail according to variants, marking screw threads on drawing.	2
<u>Laboratory lesson 7.</u> Sketches and working drawings of details. "Hexagonal nut" detail. "Hexagonal nut" detail sketching. Drawing the intersection curve of chamfer and hexagonal nut surfaces. Dimensioning. Work with reference tables and methodological guidelines to draw structural and technological elements of "Hexagonal nut" detail. Designation of materials and surface roughness on sketches and drawings. Structural and technological elements of the detail. Didactic resources: https://do.ipk.kpi.ua/mod/resource/view.php?id=61976 https://is.gd/d9AdiA	2

▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines. Recommended reading: [6], unit 2, p. 36-40, [7] Students' individual work: Sketches and working drawings of a detail according to variants.	
<u>Laboratory lesson 8. Sketches and working drawings of details. "Shaft" detail.</u> "Shaft" detail sketching according to variants. Work with reference tables and methodological guidelines to draw structural and technological elements of "Shaft" detail. Dimensioning using datum surface. Designation of materials and surface roughness on sketches and drawings. Structural and technological elements of the detail. Didactic resources: https://is.gd/d9AdiA https://do.ipk.kpi.ua/mod/resource/view.php?id=75496 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines. Recommended reading: [6], unit 14, p.230- 233, [7] Students' individual work: Sketches and working drawings of a detail according to variants.	2
<u>Laboratory lesson 9. Defence of the calculation and graphic works (CGWs).</u> Didactic resources: https://is.gd/d9AdiA https://do.ipk.kpi.ua/mod/url/view.php?id=90588 ▪ reference tables; ▪ methodological guidelines. Recommended reading: [6], unit 14, p. 230- 233, [7]. Students' individual work: Preparation for the final exam.	2

Students' individual work

Clause 5 specifies the hours allocated for students' independent work, which involves mastering the academic discipline through activities such as homework, preparation for practical lessons, calculation and graphic works, and preparedness for modular control assessment.

The name of the topic submitted for individual learning	Academic hours
Topic 1. Introduction. Point projection. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.10. Recommended reading: [1], unit 2, p.55,56,60, [4] p.6-7.	2
Topic 1.2. Straight line projection. The method of projection plane replacement. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.10. Doing an individual task of the first epure. Recommended reading: [1], unit 2, p.55,56,60, [4] p.6-7.	2
Topic 1.3. Plane projection. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.17. Doing an individual task of the first epure.	3

Recommended reading: [1], unit 2, p.65, [4] p.12-16.	
Topic 1.4. Surfaces and curves. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.22-23. Doing an individual task of the third epure. Recommended reading: [1], unit 7, p.212, [4] p.17-20.	2
Topic 1.5. Axonometric projections. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.30. Doing an individual task of the second epure. Recommended reading: [1], unit 9, p.271, [4] p.21-27.	3
Topic 2.1. Intersection of surfaces by a plane. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.36. Doing an individual task of the third epure. Recommended reading: [1], unit 9, p.271, [4] p.28-32.	3
Topic 2.2. The developed view of engineering surfaces. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.36. Recommended reading: [1], unit 9, p.271, [4] p.32-33.	1
Topic 2.3. Single and double penetration construction. Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.42. Doing an individual task of the fifth epure Recommended reading: [1], unit 10, p.288, [4] p.34-38.	1
Topic 3.1. Surface-to-surface intersection Working on the lecture materials. Doing homework on the given topic in the course workbook [5] p.47. Recommended reading: [1], unit 10, p.294, [4] p.39-43.	2
Topic 4.1 The United System for Design Documentation (ЕСКД) – the main principles. Working on the lecture materials. Drawing flat detail. Recommended reading: [3], GOST 2.301-68.-ГОСТ 2.304-80, ГОСТ 2.307-68	2
Topic 4.2. Projection drawing Working on the lecture materials. Drawing the wooden model projection. Drawing the model projection specified in 2 views. Recommended reading: [3], GOST 2.305-68.	4
Topic 4.3 Sketches and working drawings of details. Working on the lecture materials. Detail with a thread drawing. “Shaft” detail sketching. Recommended reading: [3, 7], unit 3, 4, 5, p.26-78, [1], unit 9, p.271, unit 10, p.294	5
Topic 5.1. Structural elements of assembly units. Threaded connections. Working on the practical lesson materials. Drawing the sketch of the threaded connections and its specification. Recommended reading: [4], unit 23, p.379-380.	2
Topic 5.2. Integral connections Working on the practical lesson materials. Drawing the sketch of the integral connections. Recommended reading: [4], unit 21, p.328-343.	1
Modular control assessment. Preparation for modular control assessment.	2

Recommended reading: [3], GOST 2.305-68, [1], unit 9, p.271	
Calculation and graphic work Doing an individual task of the calculation and graphic work. Preparation to its defence. Recommended reading: [1], [4], [5]	10
Exam. Preparation for the final exam. Recommended reading: [1], [4], [5]	30

Credit module 2. Engineering drawing.

Practical lessons

#	Name of a practical lesson and key issues	Academic hours
1	<u>Practical lesson 1. Assembly drawing. Sketch of the “Lid” type detail.</u> Drawing the sketch of the “Lid” type detail according to variants. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90619 - reference tables, methodical cards, task cards, samples of work, details according to variants; - methodological guidelines Recommended reading: [1], p. 66-68, [4], p. 248-283. [10], unit 1, p.13-20 [5]. Students’ individual work: Drawing the sketch of the detail.	2
2	<u>Practical lesson 2. Assembly drawing. Sketch of the “Lid” type detail.</u> Drawing the sketch of the “Lid” type detail according to variants. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning. Surface roughness parameters and detail material designation. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90616 - reference tables, methodical cards, task cards, samples of work, details according to variants; - methodological guidelines Recommended reading: [1], p. 66-68, [4], p. 248-283. [10], unit 1, p.13-20,[5]. Students’ individual work: Drawing the sketch of the detail.	2
3	<u>Practical lesson 3. Assembly drawing. Sketch of the “Body” type detail.</u> Drawing the sketch of the “Body” type detail according to variants. The peculiarities of sketching foundry details. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620	2

	https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90616 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [1], p. 72-77, [4], p. 248-283,[5]. Students' individual work: Drawing the sketch of the detail.	
4	Practical lesson 4. Assembly drawing. Sketch of the "Body" type detail. Drawing the sketch of the "Body" type detail according to variants. Creating of sections and intersections. The peculiarities of sketching foundry details. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Technical requirements. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [1], p. 72-77, [4], p. 248-283,[5]. Students' individual work: Drawing the sketch of the detail.	2
5	Practical lesson 5. Dimensioning of the "Body" type detail. The sketch of the "Body" type detail is done. Dimensioning. Surface roughness parameters and detail material designation. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [1], p. 42-77, [4], p. 248-283,[5]. Students' individual work: Dimensioning and surface roughness of the sketch detail.	2
6	Practical lesson 6. Assembly drawing. Sketch of the "Shaft" type detail. Drawing the sketch of the "Shaft" type detail according to variants. The peculiarities of dimensioning of the "Shaft" type detail. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning. Surface roughness parameters and detail material designation. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90616 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90620 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [1], p. 31-48, [4], p. 248-283,[5]. Students' individual work: Drawing the sketch of the detail.	2

7	<i>Practical lesson 7. Assembly drawing. Sketch of the “Bushing” type detail.</i> Drawing the sketch of the “Bushing” type detail according to variants. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning. Surface roughness parameters and detail material designation. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90616 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90620 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [1], p. 31-48, [4], p. 248-283,[5]. Students’ individual work: Drawing the sketch of the detail.	2
8	<i>Practical lesson 8. Assembly drawing. Conventions and simplification on the assembly drawing.</i> Assembly drawing. Purpose, features of the assembly unit image, conventions, and simplification, as recommended by standards for use on assembly drawings. Position numbers and their location, dimensioning of the assembly drawing, technical requirements, and a sketch of the general view of the assembly unit. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines Recommended reading: [4], unit 23, p.374-397. Students’ individual work: Drawing the sketch of the assembly unit.	2
9	<i>Practical lesson 9. Specification.</i> Compilation of the specification for the assembly unit. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=77294 https://do.ipk.kpi.ua/mod/url/view.php?id=90620 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines. ▪ assembly unit description. Recommended reading: [1], p. 124-130. Students’ individual work: Compilation of the specification.	2
10	<i>Practical lesson 10. Assembly drawing. Conventions and simplification on assembly drawings.</i> Assembly drawing. Determining the number of images on the assembly drawing for the assembly unit and executing the assembly drawing. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90620 ▪ reference tables, methodical cards, task cards, samples of work, details according to variants; ▪ methodological guidelines	

	Recommended reading: [4], unit 23, p.374-397. Students' individual work: Sketch of the assembly unit.	
11	<u>Practical lesson 11.</u> Comprehending the disassembly process for general view drawings. Understanding the purpose, features, principles of execution, and the designation of general view drawings. Features of the general view in detail drawings, including the selection of the main view and determining the necessary number of views. Drawing the sketch of the detail by the Ivanov drawing album (first detail). Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines. Recommended reading: [4], unit 24, p.398-408,[5]. Students' individual work: Drawing the sketch of the first detail.	2
12	<u>Practical lesson 12.</u> Comprehending the disassembly process for general view drawings. Dimensioning, considering technological and datum surfaces. Determining surface roughness of the details based on general view drawings. Drawing the sketch of the detail by the Ivanov drawing album (first detail). Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines. Recommended reading: [4], unit 24, p.398-408, [5]. Students' individual work: Dimensioning and specifying surface roughness for the first detail sketch.	2
13	<u>Practical lesson 13.</u> Comprehending the disassembly process for general view drawings. Drawing the sketch of the detail by the Ivanov drawing album (second detail). Determining of the shape of a detail by its representations in a general view drawing. Analysing the purpose and methods of connecting a detail with other parts. Determining the main view and the quantity and types of images on the drawing. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning and specifying surface roughness for the detail. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 https://do.ipk.kpi.ua/mod/url/view.php?id=90616 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines.	2

	Recommended reading: [1], p. 26-52, [4], p. 398-408, [5]. Students' individual work: Drawing and complying with the detail sketches according to individual variants.	
14	<u>Practical lesson 14.</u> Comprehending the disassembly process for general view drawings. Drawing the sketch of the detail by the Ivanov drawing album (third detail). Determining of the shape of a detail by its representations in a general view drawing. Analysing the purpose and methods of connecting a detail with other parts. Determining the main view and the quantity and types of images on the drawing. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning and specifying surface roughness for the detail. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=90618 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines. Recommended reading: [1], p. 26-52, [4], p. 398-408, [5]. Students' individual work: Drawing and complying with the detail sketches according to individual variants.	2
15	<u>Practical lesson 15.</u> Comprehending the disassembly process for general view drawings. Executing modular control assessment based on a sketch of the detail by the Ivanov atlas (forth detail). Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines. Recommended reading: [4], unit 24, p. 398-408. Students' individual work: Exploring simplifications in assembly drawings and the requirements for details' working drawings.	2
16	<u>Practical lesson 16.</u> Creating an axonometric projection of the detail based on the Ivanov drawing album. Selecting the position for the local coordinate system of the detail. Choosing between isometry or dimetry as the axonometric projection type. Performing the axonometric projection of a detail with sections. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 https://do.ipk.kpi.ua/mod/url/view.php?id=87574 ▪ reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; ▪ methodological guidelines. Recommended reading: [1], p. 26-52, [4], p. 398-408, [5].	2

	Students' individual work: Creating an axonometric projection of the individual detail based on the Ivanov drawing album. Preparing to defend the calculation and graphic work (CGW)	
17	Practical lesson 17. Revision lesson. Defence of the calculation and graphic work (CGW). Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 - reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; - methodological guidelines. Recommended reading: [4], unit 24, p.398-408. Students' individual work: Exploring simplifications in assembly drawings and the requirements for details' working drawings.	2
18	Practical lesson 18. Final drawing Drawing the sketch of the detail by the Ivanov drawing album (a detail of average complexity.). Drawing the sketch of the detail by the Ivanov drawing album. Determining of the shape of a detail by its representations in a general view drawing. Analysing the purpose and methods of connecting a detail with other parts. Determining the main view and the quantity and types of images on the drawing. Work with reference tables and methodological guidelines to draw structural and technological elements of the detail. Dimensioning and specifying surface roughness for the detail. Didactic resources: https://do.ipk.kpi.ua/mod/url/view.php?id=90619 - reference tables, methodical cards, task cards, samples of work, individual assembly drawing by the Ivanov drawing album; - methodological guidelines.	2

Students' individual work

#	The name of the topic submitted for individual learning	Academic hours
1	Topic 1.1. Sketching the assembly unit details. Working on the practical lesson materials. Drawing the sketches of the details. Recommended reading: [1], p. 42-77, [4], p. 248-283, [5]	1
2	Topic 1.2. Assembly drawing. Working on the practical lesson materials. Creating the assembly drawing. Recommended reading: [4], unit 23, p.374-397.	2
3	Topic 1.3 Compilation of the assembly unit specification. Working on the practical lesson materials. Compilation of the specification. Recommended reading: [1], p. 124-130, [4], unit 23, p.379-380.	1
4	Topic 2.1. General view drawings reading. Working on the practical lesson materials. Recommended reading: [4], unit 24, p.398-408, [5]	1
5	Topic 2.2. Detailing according to the general view drawing.	2

	Working on the practical lesson materials. Creating the drawing of the detail. Recommended reading: [4], unit 24, p.398-408, [5]	
5	Modular control assessment. Exploring simplifications in assembly drawings and the requirements for details' working drawings. Recommended reading: [4], unit 24, p.398-408	2
6	Calculation and graphic work. Working on the practical and laboratory lessons materials. Creating drawings of the individual details. Recommended reading: [1], [4],[5], [10]	10
7	Final drawing. Exploring simplifications in assembly drawings and the requirements for details' working drawings. Recommended reading: [1], [4], [5],[10]	5
In total		24

Academic policy and control

6. The policy of the academic discipline (educational component)

In order to study academic discipline “Engineering Graphics” a higher education student is required to:

- comply with educational and academic ethics;
- stick to the schedule of the educational process;
- be responsible and attentive at lessons;
- work on theoretical material systematically;
- stick to the schedule of calculation and graphic work (CRW) defence.

The student’s answer must demonstrate that the given task has been completed independently, without any repetition and plagiarism.

If the student does not attend a lecture, they are supposed work on this lecture at a different time (with another group, at a consultation, on their own using methodological materials published on remote learning platform “Sikorsky”, video lessons etc.).

If the student does not attend a lecture, they are supposed work on this practical lesson’s material at a different time (with another group, at a consultation, on their own using methodological materials published on remote learning platform “Sikorsky”, video lessons etc.).

7. Types of control and ECTS grading scale (rating system of learning outcomes evaluation)

Credit module 1. Engineering graphics.

1. The student’s credit module rating is calculated from 100 points. 50 points are the starting scale. The starting rating (during the term) includes points given for

- Homework (HW) and lesson assignments on the lecture topic (7 topics);
- Programmed control work (PC) (7 drawings);
- Completing and defending graphic work (GW) (14 drawings)
- Calculation and graphic work (CGW);
- Modular control assessment (MCA).

2. Grading criteria:

2.1. Doing homework:

- Doing homework at least 70%– 1 point.

2.2. Doing programmed control work:

- excellent work – 2 points;
- there are some mistakes and/or not fully completed work – 1 point

2.3 Completing and defending graphic work

- excellent or well-done work and a fair answer to the question – 1 point;
- there are some mistakes and/or not correct answer to the question – 0 point;

2.4 Doing calculation and graphic work:

- creative work – 10-9 points;
- work is done with some minor shortcomings – 8-7 points;
- work is done with some mistakes– 6 points;
- work is failed (the task is not completed or there are serious mistakes) – 0 points.

Every week of breaking a deadline for turning in calculation work will bring one penalty point (in total maximum 5 points).

2.5. Modular control assessment

- creative work – 5 points;
- work is done with some minor shortcomings – 5-4 points;
- work is done with some mistakes– 3 points;
- work is failed (the task is not completed or there are serious mistakes) – 0 points.

3. In order to get the first credit a student is supposed to have minimum 8 points and complete all the graphic work (at the time of crediting). In order to get the second credit a student is supposed to have minimum 22 points and complete all the graphic work (at the time of crediting) and calculation and graphic work.

4. In order to be allowed to take an exam a student is supposed to turn in all the homework, graphic work, calculation work and starting rating minimum 30 points.

5. Students do a written exam. Each task includes 2 theoretical questions (tasks) and 2 practical ones. The list of questions is given in Credit module learning outcomes. Each task is assessed 12-13 points according to such criteria:

- «excellent», full answer, min 90% of necessary information (full solving the problem without any mistakes) – 12-10 points;
- «good», sufficiently full answer, min 75% of necessary information or minor inaccuracies (full solving the problem with some minor inaccuracies) – 9-8 points;
- «satisfactory», incomplete answer, min 60% of necessary information and some mistakes (the task is done with some shortcomings) – 7-6 points;
- «unsatisfactory», the answer doesn't comply with "fair" requirements – 0 points.

Calendar control as a measure to monitor the current compliance with the syllabus requirements takes place twice a term.

In order to pass the first calendar control a student is supposed to have min 18 points, complete and defend three topics in the course workbook, one graphic work and positive grades for two programmed control works. In order to pass the second calendar control a student is supposed to have min 45 points, complete and defend three topics in the course workbook, one graphic work, positive grades for two programmed control works and completing calculation and graphic work. In order to get

the credit a student is supposed to complete and defend calculation and graphic work, tasks on 7 topics in the course workbook, 2 graphic works, positive grades for four programmed control works and modular assessment work.

The table of compliance of points to grades according to the university scale:

Points: HW + PC + GW + CGW + MCA + + exam	Grade
100...95	Excellent
94...85	Very good
84...75	Good
74...65	Satisfactory
64...60	Pass
Less than 60	Fail
There are failed works or failed calculation and graphic works or starting rating is less than 30 points	Not allowed to pass the exam

Credit module 2. Engineering drawing.

1. The student's credit module rating is calculated on a 100-point scale and includes points awarded for:

- Completing and defending graphic work (GW) (11 drawings);
- Modular control assessment (MCA);
- Calculation and graphic work (CGW).

2. Grading criteria.

2.1. Completing and defending graphic work:

- «excellent» – excellent or well-done work and a comprehensive answer to the question (providing not less than 90% of the necessary information), excellent graphics – 5 points;
- «good» – the task is considered complete a correct answer to the questions (providing at least 75% of the necessary information), good graphics– 4 points;
- «satisfactory» – the task is completed with mistakes that were corrected by the teacher, answer to the question is enough (providing at least 60% of the necessary information), satisfactory graphics – 3 points;
- «unsatisfactory» – the task failed or response does not meet the requirements for «satisfactory» – 0 points.

Completion of all planned graphic works with positive marks is a prerequisite for admission to the final drawing.

2.2. The modular control assessment is out of 20 points:

- «excellent» – skilful and creative task performance with a deep understanding of the material – 18-20 points;
- «good» – task performance at a minimum of 80%, with minor inaccuracies allowed – 14-17 points;
- «satisfactory» task performance of at least 60%, with minor mistakes allowed – 12-13 points;
- «unsatisfactory» – task failure or completion of less than 59% – 0 points.

2.3. Calculation and graphic work assessment is out of 25 points according to such criteria:

- «excellent» – skilful and creative task performance, excellent graphics – 25-22 points;

- «good» – complete disclosure of the problem, good graphics – 21-17 points;
- «satisfactory» – disclosure of the problem with some shortcomings, or an unsuccessful layout of the drawing, satisfactory graphic – 16-15 points;
- «unsatisfactory» – incomplete task, work do not meet the required standards, resulting in a failure – 0 points.

Penalty points are awarded for each week of delay in submission of calculation and graphic work – 2 points (not exceeding 6 points in total). A positive assessment from the CGW is required for admission to the final drawing.

2.5. Final drawing assessment is out of 20 points. The control task for this work includes two questions from the Complex of control tasks for credit.

The first question is graded using the following criteria, worth 5 points:

- «excellent» – complete response (minimum 90% of required information), suitable justification, and personal opinion included – 5 points;
- «good» – adequate response (at least 75% of the required information), with minor inaccuracies – 4 points;
- «satisfactory» – partial response (at least 60% of the required information, with some mistakes) – 3 points;
- «unsatisfactory» – provided response is unsatisfactory – 0 points.

The first question is graded using the following criteria, worth 15 points:

- «excellent» – complete response (minimum 90% of required information), suitable justification – 15 - 14 points;
- «good» – adequate response (at least 75% of the required information), with minor inaccuracies – 13 - 10 points;
- «satisfactory» – partial response (at least 60% of the required information, with some mistakes) – 9 points;
- «unsatisfactory» – provided response is unsatisfactory – 0 points.

3. In order to get the first credit a student is supposed to have minimum 27 points and complete 2 graphic works. In order to get the second credit a student is supposed to have minimum 45 points and complete 7 graphic works.

4. In case the student passes CGWs and graphic works, the sum of rating points accumulated during the term is transformed into a final grade according to the table (paragraph 6). If the sum is less than 60, the student does the final assessment drawing. The sum of CGWs, graphic works and final assessment is transformed into a final grade according to the table (paragraph 6).

5. If the student has accumulated more than 60 points, but they want to get more, they can do the final assessment drawing. The final score is the sum of the final assessment drawing, CGWs and graphic works.

6. The table of compliance of points to grades according to the university scale:

Points	Grade
100...95	Excellent
94...85	Very good
84...75	Good
74...65	Satisfactory
64...60	Pass

Points	Grade
Less than 60	Fail
There are failed works or failed calculation and graphic works	Not allowed to pass the exam

8. Additional information on discipline (educational component)

Earning credit and passing the examination through assigned tasks. Each ticket includes either four or two tasks. These tasks assess competencies related to modelling geometric objects and the ability to apply design documentation standards.

The Working Program of the Academic Discipline (Syllabus):

Composed by: Senior Teacher of the Department of Descriptive Geometry, Engineering and Computer Graphics Hanna Shepel

Adopted: Department of Descriptive Geometry, Engineering and Computer Graphics (protocol #10, 11 June 2024)

Agreed: Methodological Commission of Institute of Atomic and Thermal Energy (protocol #10, 25 June 2024)