

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National Aviation University
Educational and Research Institute of Airports
Computer Technologies of Design and Graphics Department

APPROVED
Acting Rector

«12» 12. 2016



Quality Management System

SYLLABUS

on


«Descriptive Geometry»

Field of Study: 13 «Mechanical Engineering»
Speciality: 134 «Aviation and Space Rocket Technology»
Specializations: «Airplanes and Helicopters»
«Aircraft Equipment»

Year of Study – 1 st		Semester – 1 st
Classroom Sessions	– 51	
Self-study	– 39	Graded Test – 1 st semester
Total (hours/ECTS credits)	– 90/3,0	

Index CB -1-134/16-2.1.4

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The Syllabus on “Descriptive Geometry” is based on the educational and professional program and Bachelor Curriculum № CB -1-134/16 for Speciality 134 «Aviation and Space Rocket Technology» and Specializations: «Airplanes and Helicopters», «Aircraft Equipment» and correspondent normative documents.

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Discussed and approved by the Graduate Department for the Speciality 134 «Aviation and
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Discussed and approved by the Graduate Department for the Speciality 134 «Aviation and
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Discussed and approved by the Scientific-Methodological-Editorial Board of the Educational and
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1. EXPLANATORY NOTES

The Syllabus on " Descriptive Geometry" is developed on the basis of “Methodical instructions for development and issuance of syllabus and course training programs of the subjects” enacted by order as of 16.06.2015 №37/поз.

This education discipline “Descriptive Geometry and Engineering Graphics” lays the foundation of engineering education, forming knowledge and skills of geometric modeling of three-dimensional objects of space.

The purpose of teaching of discipline is opening of modern scientific conceptions, notions and methods of display geometrical properties of technical objects in the form of design drawings.

Objectives to study the subject are:

- mastering theoretic basis methods of imaging space forms on the plane;
- development imaginary skills of reproduction space forms by its plane images;
- analysis of algorithms for solving positional and geometric problems of geometrical modeling metric of space forms with their images.

As the result of mastering the discipline a student should:

To know:

- the essence of method of projections;
- theoretical bases and methods of construction of orthogonal and axonometric projections of space objects;
- graphical receptions of decision of tasks of the geometrical constructing, links mainly with determination of form sizes and mutual location of objects after a draft.

To be able:

- independently perform projective drawings;
- independently recall in the mind space prototypes of real or projected products, their shape, sizes (read drawing);
- independently develop a plan and determine a method of solving positional and metric tasks of geometric modeling of space forms by its orthogonal or axonometric images.

Educational material of discipline is structured on the module principle and consists of two educational modules, namely:

- of the educational **module №1 “Bases of geometric modelling”**,
 - of the educational **module №2 «Modelling of space objects »**,
- each of which is logically complete, relatively independent, integral part of the educational discipline, learning of which provides of Module test and analysis of its implementation.

Discipline "Descriptive Geometry" knowledge-based of disciplines "Higher Mathematics" and is the basis for the study of subject "Engineering and Computer Graphics"

2. SUBJECT CONTENT

2.1.Module #1 "Bases of geometric modelling"

Topic 2.1.1. Introduction. Method of projections

Definition of descriptive geometry and its applications. Basic concepts of geometric modeling space. Reconstruction of Euclidean space. Definition of projection systems. Method of two images. Analysis of the main imaging and projecting systems. The projection model which consisting of the orthogonal projections of points of the object on mutually perpendicular plane of projections. Multiview drawing of Monge.

Topic 2.1.2. Orthogonal projections of main elements of geometrical space

Complex drawing of point. Quarters and signatures of points. Defining the relative disposition of a pair of points.



Complex drawing of line. Properties of projections of lines in relative to the plane of projections: oblique, level, proekting.

Determining the length of segment and angles of inclination the oblique straight line. Displays the relative position of intersecting, parallel, non-intersecting straight lines.

Complex drawing of plane. Properties of projections of plane by changing their position relative to the planes of projections: oblique, level, projekting. Belonging point and line to plane. Displays the relative position of a pair of planes: intersecting planes, parallel planes.

Displays the relative position of the plane and straight line: intersecting objects, parallel objects.

Example of designing of the landing gear of the aircraft using the positional and metric problems of point, straight line, plane.

Topic 2.1.3. Methods of transformation of orthogonal drawing.

The theoretical basis and practical application of methods of transformation of orthogonal drawings in metric and positional problems of designing of technical products. Classification of the methods of transformation of orthogonal drawings.

The method is based on replacing of the planes of projections and maintaining the direction of projection. The essence of the method. Four main transformation of descriptive geometry by replacing the planes projections.

The method is based on the change in position of the object relative to the plane of projections - plane-parallel shift. The essence of the method. Four main transformation of descriptive geometry by plane-parallel shift.

Examples of designing of technical products using the methods of transformation of orthogonal drawings.

2.2. Module #2 "Modelling of space objects"

Topic 2.2.1. Polyhadrons.

Determinants facet surfaces. Facets torsos, pyramids and prisms. Body of Plato. Euler's theorem for convex polyhedrons. Plane sections of polyhedrons. The intersection of the straight line with the edge surfaces. Methods of construction of developments of face surfaces (triangulation, normal section, paste).

Mutual intersection of polyhedrons.

Topic 2.2.2. Curved lines.

Curves lines in science and technology, methods of default. Classification of curves lines. Plane curves. Curvature of a plane curve and its evolute and involute. The curves of the second order. Evolvent of circle. Cylindrical and conical screw line.


Construction of contour curves of the second order by using the engineering discriminant as an example of drawing of the fuselage of the aircraft.

Topic 2.2.3. Curves surface.

Classification of curved surfaces by types of generators and algorithms of creation; use in the construction of aircraft and ground equipment. Curves surfaces with generatrices. Curves surfaces of rotation. Screw surfaces. The image on drawings and studies of properties of projections of curved surfaces.

Determining the belonging of point to the curve surface. The intersection of the curve surface with a straight line. Methods of construction of plane sections of curved surfaces. Methods of construction of line of mutual intersection of surfaces using auxiliary cutting planes and spheres. Mutual intersection of curved surfaces of the second order for the plane curves.

Developments of curved surfaces: approximate (cone and cylinder), conventional (sphere).

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Topic 2.2.4. Axonometric projections of solids.

The essence of method of axonometric projection, axonometric main theorem and its consequences, the types of axonometric, the relationship between indicators of distortion and direction of proekting.

Standard axonometric projection using ГОСТ 2.317–79. Constructing of axonometric images of objects by their image in the standard orthogonal and oblique projections.

3.LIST OF REFERENCES

3.1. Basic literature

3.1.1. *Михайленко В.Є.* Нарисна геометрія: підручник / В.Є. Михайленко, М.Ф. Євстигнєєв, С.М. Ковальов. За ред. В.Є. Михайленка. 3-тє вид., переробл. – К.: Видавничий дїм «Слово». 2013. – 304 с.

3.1.2. *Ковальов Ю.М.* Прикладна геометрія: підручник / Ю.М. Ковальов, В.М. Верещага. – К.: Дїя. 2012. – 472 с.

3.1.3. *Хмеленко О.С.* Нарисна геометрія: підручник. / О.С. Хмеленко – К.; Кондор, 2008. – 440 с.

3.1.4. *Гордон В.О.* Сборник задач по курсу начертательной геометрии: учебное пособие / В.О. Гордон, Ю.Б. Иванов, Т.Е. Солнцева. 7-е изд. – М.: Высшая шк. 1988. – 320 с.

3.2. Additional literature

3.2.1. *Ковальов Ю.М.* Основи геометричного моделювання: навч. посїб. / Ю.М. Ковальов – К.: Вища шк. 2003. – 232 с.

3.2.2. *Макаров В.І.* Нарисна геометрія. Інженерна та комп'ютерна графіка: навч. посїб. / В.І. Макаров, В.Г. Шевченко, М.Г. Макаренко та ін.. – К.: Книжкове вид-во НАУ, 2006, 259 с.



(Ф 03.02 – 04)

АРКУШ РЕЄСТРАЦІ РЕВІЗІЇ

№ пор.	Прізвище ім'я по-батькові	Дата ревізії	Підпис	Висновок щодо адекватності

(Ф 03.02 – 03)

АРКУШ ОБЛІКУ ЗМІН

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульованого			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				