

NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"Igor Sikorsky Kiev Polytechnic Institute"

PHYSICO-MATHEMATICAL FACULTY

APPROVED

Academic Council

Physics and Mathematics Faculty

Minutes No. 2 of April 6, 2017

Chairman of the Academic Council _____ V.V. Vanin

PROGRAM

Basic entrance exam to postgraduate study

The third (educational-scientific) level of higher education

For the degree of doctor of philosophy

Field of Knowledge 13 Mechanical Engineering

SPECIALTY 131 Applied Mechanics

SPECIALIZATION Applied geometry, engineering graphics

Program developers:

Gennadiy Virchenko Ph.D., associate
professor, professor of the department

Anatolievich Descriptive geometry,
engineering and

Computer graphics _____

Accepted by the Academic Council

Faculty of Physics and Mathematics

(Minutes from April 6, 2017, No. 2)

I. INTRODUCTION

This program contains information about the content of the training material, which is issued on the entrance exam of the third (educational-scientific) level higher education for obtaining a scientific degree of the doctor of philosophy in the field of knowledge "Mechanical Engineering", specialty "Applied Mechanics", specialization "Applied Geometry, Engineering Graphics".

The purpose of the entrance exam is to clarify the quality of knowledge and available abilities of entrants from the chosen educational-scientific direction of a professional training. During the entrance examination, the assessment is carried out theoretical preparation of entrants, level of their mental abilities, skills logically think, perform analysis and generalization of complex scientific tasks, possibilities of effective application of the received knowledge in practice etc.

This program consists of an introduction, a list of educational material, which is made on the entrance exam, recommended literature, criteria assessment of the entrance examination and the example of the examination ticket.

An introductory exam is conducted orally at the exam tickets. When answering the proposed questions is necessary demonstrate good theoretical knowledge and appropriate practical skills.

Each exam paper contains three theoretical questions respectively from the section "Applied Geometry", "Engineering Graphics", "Computer graphics. "

The main task of this program is to provide the opportunity successfully prepare for the entrance exam.

II. LIST OF EDUCATIONAL MATERIAL

SECTION 1. APPLIED GEOMETRY.

1.1. Analytical geometry.

Cartesian coordinates on a plane and in space. Straight and plane.

Conical sections. Surfaces of the second order. Vectors and operations on them.

Transformation of coordinates (orthogonal, affine, projective).

1.2. Descriptive geometry.

Projection method. Central, parallel and orthogonal

Projection Classification of lines, surfaces and bodies. Projection points

Direct and curved lines, surfaces and bodies. Transform orthogonal

Projections (methods of plane-parallel transfer and replacement of planes

Projections). Evolute and involute. Positive tasks. Intersection of lines

Surfaces and bodies. Metric tasks. Spreads of surfaces. Axonometric

Projections

1.3. Differential geometry.

Parametric curves of the line. The tangent, the curvature and the difficulty of the line. Formulas

Serre Frenne Parametric surfaces. Curves on the surfaces. First and second

Quadratic forms of the surface. Geodesic lines. Curves and surfaces are formed.

SECTION 2. ENGINEERING GRAPHICS.

2.1. Machine-building drawing.

Geometric constructions Drooping General rules of registration shredders Images (views, cuts, cross-sections). Sizing.

Typical detail elements. Pullovers of parts and folding units.

Connections are demountable and non-detachable. Specifications. Schemes (kinematic, electric, hydraulic, pneumatic, structural, functional assembly etc).

2.2. Graphic tools in modern automated systems

Design (CAD).

Technical and software graphic tools CAD. Automated geometric modeling of technical objects and processes. Parametric construction of parts and folding units. Automation tools geometric constructions. The circulation of electronic design and technological documents in CAD.

Dynamic geometric modeling of parts manufacturing processes folding units.

SECTION 3. COMPUTER GRAPHICS.

3.1. Basic provisions of computer geometric modeling.

Raster and vector graphics, use of color. Types geometric models. Basic methods and methods of geometrical constructions.

3.2. Modern computer graphic technologies.

Automated construction of points, lines, surfaces and bodies in systems automated design dynamic shaping of geometric figures

3.3. Mathematical foundations of computer graphics.

Converting coordinates on a plane and in three-dimensional space.

Matrix transformations using homogeneous coordinates (parallel transfer, rotation, zoom, symmetry, shift). Compositions transformations.

Methods of interpolation and approximation. Cubic splines. Curves Bezier. IN- splines, Rational B-splines,. Surface of Bezier, Kunsu. In-spline

The surface Rational B-spline surfaces.

Solid-state modeling. B-rep, C-rep and O-rep methods. Application

Boolean operations. Parametric computer geometric modeling lines, surfaces and bodies

III. CRITERIA OF EVALUATION OF INTRODUCED EXPIRES

During the exam, admitters are prohibited from using any one auxiliary literature in paper, electronic form, etc. The examination score consists of the points that an entrant receives for answers to questions of a ticket: maximum 35 points for the first and second question and a maximum of 30 points for the third question.

Thus, the answer of an entrant is estimated on a 100-point scale.

Criteria for assessing answers to the first and second questions:

33 ... 35 points - the correct complete answer;

30 ... 32 points - the correct complete answer with minor inaccuracies;

26 ... 29 points - the correct answer is sufficient enough with a minor inaccuracies;

23 ... 25 points - basically the correct, somewhat incomplete answer;

21 ... 22 points - basically the correct somewhat incomplete answer from individual errors;

Less than 21 points - incomplete answer with significant mistakes.

Criteria for assessing answers to the first and second questions:

28 ... 30 points - the correct complete answer;

25 ... 27 points - the correct complete answer with minor inaccuracies;

22 ... 24 points - the correct answer is sufficient enough with minor ones inaccuracies;

20 ... 21 points - basically correct, somewhat incomplete answer;

18 ... 19 points - basically the correct somewhat incomplete answer from individual errors;

Less than 18 points - incomplete answer with significant mistakes.

The total number of points is determined by summing the points on ticket question the conversion of the points obtained into the ECTS score is performed according to the following table.

Amount of points scored	Score
95...100	A
85...94	B
75...84	C
65...74	D
60...64	E
Less 60	F