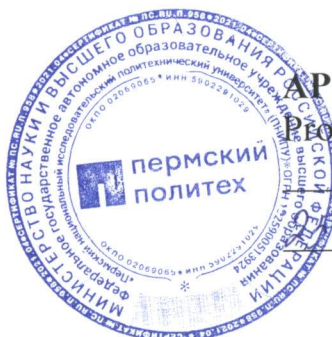Ministry of Science and Higher Education of the Russian Federation

Federal State Autonomous Educational Institution of Higher Education
Perm National Research Polytechnic University

ACADEMIC COURSE WORKING PROGRAM

Academic course: ___Engineering geometry and computer graphics___
(Name)
Form of education: _____Full-time_____
(Full-time /full-time - correspondence/correspondence)
Level of higher education: ___Bachelor's program___
(Bachelor's program/specialist program/Master's program)
Workload in hours (in credits): ___144 (4)___
(Hours (CU))

Training program (degree): ___15.03.06 Mechatronics and Robotics___
(Code and denomination of degree)
Direction: ___Mechatronics and Robotics___
(Title of curriculum)

Perm 2021

1. General Provisions

1.1. Goals and Objectives of the Course

The goal of the course is to prepare graduates who are proficient in modern methods of geometric modeling, capable of using information technologies, applied software tools in the development of working design and technical documentation.

1.2. Studied Objects of the Course

theoretical foundation of constructing drawings of objects on a plane; the basics of geometry construction and the structure of design documentation; solid modeling programs (CAD), e.g. Solid Edge

1.3. Starting Conditions

Unstipulated

2. Planned Results of the Course Training

Competence	Indicator's Index	Planned Results of the Course Training (to know, to be able, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
GPC-7	**IA-1.**gpc-7	**To know** the content of engineering documentation models connected with professional activity; the theoretical foundation of constructing drawings of objects on a plane; the techniques for determining the forms and dimensions of objects	**Knows** the content of engineering documentation models connected with professional activity.	Progress check
GPC-7	**IA-2.**gpc-7	**To be able to** use the basic types and content of engineering documentation models connected with professional activity; to demonstrate the ability to generalize information and put it into the blanks of models in accordance with active standards; to solve technical design problems using traditional tools or CAD	**Is able to** use the basic types and content of engineering documentation models connected with professional activity; demonstrates the ability to generalize information and put it into the blanks of models in accordance with active standards.	Case-task

GPC-7	IA-3.•gpc-7	**To master the skills** of reporting, making reviews, references, requests and etc. relying on real situation; of performing projects in 3D and intellectual capability of space perception; of handling the software for geometric modeling and visualization.	**Masters the skills** of reporting, making reviews, references, requests and etc. relying on real situation.	Grading test

3. Full time and forms of academic work

Form of academic work	Hours in all	Distribution in hours according to semesters		
		Number of semester		
		I	II	III
1. Holding classes (including results monitoring) in the form: 1.1.Contact classwork, including:				
- lectures (L)	18			18
- laboratory work (LW)	16			16
- practice, seminars and/or other seminar-type work (PW)	25			25
- control of self-work (CSW)	4			4
- test				
1.2. Students' self-work (SSW)	81			81
2. Intermediate attestation				
Grading test				
Workload in hours	**144**			**144**

4. Course outline

Name of the units with the course outline	Full time of classroom activity in hours according to the forms			Full time of extracurricular work in hours according to the forms
	L	LW	PW	SSW
3rd semester				
Basic Geometrical Definitions. A straight line and a point. A curved and a broken line. Angles, plane figures: triangles, quadrilaterals, polygons, circles. Surfaces. Geometrical problems.	2	4		8
Projections. Types of projections. The multiview drawing of a point and a straight line. The transformation of projections. The true length of a line and its angles of inclination. The projections and positions of the given plane relative to the planes of projections. The multiview drawing of geometrical bodies and curved surfaces. Projections of points and lines on their surfaces. Intersection of planes and	10	4	10	20

surfaces.				
Design Solid Models. First angle projection method. Technical documentation. Principal Views. Types of cross-sections. Basic dimensioning rules. Geometric properties of a solid. 3D modeling. A basic solid modeling process: sketch a section and extrusion. Visualization of the internal or hidden features of a solid model.	6	8	8	26
Assembly Drawings. Standardization of threads. Geometric construction. Threads and standard fasteners. Fastener Dimension Tables. 3D CAD fastener drawings.			7	27
Total with regard to semester	18	16	25	81
Total with regard to the course	18	16	25	81

Topics of exemplary practical work

Sl. №	Topic of practical (seminar) work
1	Types of projections. The multiview drawing of a point.
2	The straight line. The multiview drawing of a straight line. The positions of straight lines relative to the planes of projections. Relative position of points and lines, two lines. The transformation of projections.
3	Projecting planes. Oblique planes. Level lines in a plane.
4	Relative position of lines and planes, two planes.
5	Representations of geometrical bodies and surfaces. Curved surfaces. Projections of points and lines on the surfaces.
6	Intersection of planes and surfaces. Plane section of polyhedrons and curved surfaces. Conic sections.
7	Standard of technical drawing. Orthographic projection. First angle projection method. Principal views.
8	Different types of sectional views. Full sections and half sections. Section lining.
9	An offset section. Broken-out section view. Removed section.
10	Machine screws. Simplified representation. External and internal thread.
11	Stainless machine screws. The bolts, the nuts and the washers.
12	An assembly drawing.
	Grading test

Topics of exemplary laboratory practice

Sl. №	Topic of laboratory work
1	Solid Edge user interface basics. Sketching. The geometrical primitives.
2	Drawing commands. Sketch geometric relationships. Dimensioning commands.
3	The engineering sketches. 2D parametric constraints.
4	Solid modeling. The basic principles of 3d modeling. Coordinate systems.
5	Feature-based modeling workflow. Constructive solid geometry.
6	Parametric 3d modeling techniques. Modeling assemblies.
7	Parametric 3d modeling techniques. Modeling assemblies.
8	Grading test

5. Organizational and Pedagogical Conditions

5.1. Educational Technologies Used for Competences Formation

The integrative educational discipline "Engineering Geometry and Computation Graphics" implements within the foundation part of the higher educational specialized program "Construction". Graphic training is the first professionally oriented discipline at a technical university. Within the framework of subject training, it is important to create a learning environment that is close to professional.

Holding lectures in the discipline is based on the active method of training in the process of which students are not passive but active participants of the lesson answering questions of the teacher. Teacher's questions are aimed at activating the process of learning material as well as at the development of logical thinking. The questions stimulating associative thinking and connecting new material with the previous one are identified by the teacher in advance.

Practical lessons are held by realization of the method based on active training: problem areas are determined, groups are formed. The following aims are pursued in the process of practical education: use of definite disciplines knowledge and creative methods in solving problems and decision-making; students' skill-building of teamwork, interpersonal communication and development of leadership skills; consolidation of the basic theoretical knowledge.

Laboratory classes are based on an interactive learning method in which students communicate not only with the teacher but also with each other. At the same time, students ' activity in the learning process dominates. The teacher's place in interactive classes is reduced to orienting students ' activities to achievement of the goals of studies.

Interactive lectures, group discussions, role-playing games, training sessions, and analysis of situations and simulation models are used in academic studies

The course project, carried out as part of the out-of-class independent work of students, allows you to consolidate design skills, gain experience in designing specific technical objects, and improve the skills of graphic design of design results..

5.2. Students' Manual for the Course Study

Learning the course students are recommended to fulfill the following positions:

1. Learning of the discipline should be done systematically.

2. After learning one of the course unit with the help of the text-book or lecture notes it is recommended to reproduce in memory the basic terms, definitions, notions of the unit.

3. Special attention should be paid to the reports on practical studies, laboratory works and individual complex tasks for self-work.

4. The topic of questions studied individually is given by the teacher at the lectures. Also the teacher refers to the literary resources (first of all, to the newly published in periodicals) in order the students understand the problems touched on the lectures in detail.

6. List of Teaching Materials and Information Supply for Students' Self work in the Discipline

6.1. Paper-based courseware

Sl.№	Bibliographic entry (author, title, mode of publication, place, publishing house, year of publication, number of pages)	Number of copies in the library
1. Basic literature		
1	Earle J. H. Engineering Design Graphics. 6th ed Reading,Massach : Addison-Vesley Publ. Co, 1990. 849 p.	1
2	Earle J. H. Engineering Design Graphics. 5th ed Reading, Massachusetts : Addison-Vesley Publ. Co, 1987. 846 p.	1
3	Rajaraman A. Computer Graphics for Engineers. Oxford : Alpha Science Intern. Ltd, 2009. 116 p.	1
2. Additional literature		
2.1. Educational and scientific literature		
1	Bertoline et al. Fundamentals of Graphics Communication. 6e.	
2	Goetsch D. L., Nelson J. A. Technical Drawing and Design. New York : Delmar Publ., 1986. 751 p.	1
3	Evans P. Extraordinary Graphics For Unusual Surface : Making the Most of Hard-to-Design Spaces. Gloucester, Massachusetts : Rockport Publ., 2002. 190 p.	1
4	Cullen C.D., Haller L. Design Secrets: Products 2 : 50 Real-Life Projects Uncovered. Gloucester, Massachusetts : Rockport Publ., 2004. 208 p.	1
5	Gambhir M. L. Stability Analysis and Design of Structures. Berlin : Springer, 2004. 535 p.	1
6	Communicate: Independent British Graphic Design since the Sixties / Crowley D., Macdonald N., O'Reilly J., Poynor R. London : Laurence King Publ., 2004. 255 p.	1
7	Peters. R.L. Worldwide Identity: inspired design from forty countries : [Album]. Gloucester, Massachusetts : Rockport Publ., 2005. 256 p.	1
8	Glendinning E. H., Glendinning N. Oxford English for Electrical and Mechanical Engineering : Student's Book. Oxford : Oxford Univ. Press, 2010. 190 p.	50
2.2. Standardized and Technical literature		
4. Teaching and learning materials for students' self-work		

6.2. Electronic Courseware

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet/local net;

			authorized free access)
Additional literature	Digital control engineering : analysis and design / New York : Elsevier, 2009.	URL: https://elib.pstu.ru/Record /RUPNRPUelib4243	authorized free access
Additional literature	Vostrikova S. Graphic Design Lexicon. M., 2012.	URL: https://elib.pstu.ru/Record /lan73833	authorized free access
Additional literature	Vadim A. Z., Lubomir V. D., Jaroslav N. Numerical Optimization of Regulators for Automatic Control System : textbook for higher education. Novosibirsk: NSTU, 2019.	URL: https://elib.pstu.ru/Record /lanRU-LAN-BOOK-152223	authorized free access

6.3. License and Free Distributed Software used in the Course Educational Process

Type of Software	Software branding
OS	Windows 10 (Azure Dev Tools for Teaching)
Office Applications	Adobe Acrobat Reader DC
Image processing software	Corel CorelDRAW Suite X4
General purpose application software	Mathematica Professional Version (licence L3263-7820*)
General purpose application software	Microsoft Office Visio Professional 2016 (Azure Dev Tools for Teaching)
General purpose application software	WinRAR (licence № 879261.1493874)
Management systems for projects, research, development, design, modeling and implementation	Autodesk AutoCAD 2019 Education Multi-seat Stand-alone

6.4. Modern Professional Databases and Inquiry Systems Used in the Course Educational Process

Branding	Reference to information resource
Scopus database	*https://www.scopus.com/*
Web of Science Database	*https://www.webofscience.com/*
Scientific electronic library database (eLIBRARY.RU)	*https://elibrary.ru/*
Scientific Library of the Perm National Research Polytechnic University	*https://lib.pstu/*
Lan Electronic Library System	*https://e.lanbookshop.ru/*
Electronic library system IPRbooks	*https://www.iprbookshop.ru/*
Information resources of the Network ConsultantPlus	*https://www.consultant.ru/*
Company database EBSCO	*https://www.ebsco.com/*

7. Logistics of the Course Educational Process

Type of classes	Name of the necessary basic equipment	Number of units
Laboratory work	PC Intel Pentium Dual CPU MHz	60
Lecture	Type 2 multimedia complex (laptop, projector, interactive board)	5
Practical class	PC Intel Pentium Dual CPU MHz	15

8. Fund of the Course Evaluating Tools

Presented in a separate document