Ministry of Science and Higher Education of the Russian Federation

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

APPROVED BY
Pro-rector for Academic Affairs
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25 11 2021г.

ACADEMIC COURSE WORKING PROGRAM

Academic course: Ecology
(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 (credits): 108 (3)
(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 goals of the course is to form knowledge, skills and abilities in the field of environmental safety, ensuring environmental protection from pollution and rational use of natural resources.

1.2. Studied Objects of the Course

Environmental objects (atmospheric air, surface and underground water bodies, soil, subsoil), objects of the biosphere and technosphere, sources of environmental pollution, technologies for protecting the environment from technogenic impacts.

1.3. Starting Conditions

Instipulated

2. Planned Results of the Course Training

Competence	Indicator's Index	Planned Results of the Course Training (to know, to know how, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
GPC-1	IA-3$_{GPC-1}$	**To master** solving problems in the field of environmental protection and rational nature management related to professional activity, using methods of modeling, mathematical analysis, natural science and general engineering knowledge.	**Masters** solving problems related to professional activity, using methods of modeling, mathematical analysis, natural science and general engineering knowledge	Test
GPC-2	IA-1$_{GPC-2}$	**To know how** to design technical objects, systems and technological processes, taking into account environmental restrictions at all stages of the life cycle of technical objects and processes, to know the main aspects of the impact of technical objects and processes on the environment and ways to minimize negative impact.	**Knows** ways of designing technical objects, systems and technological processes taking into account economic, environmental, social and other restrictions	Test
GPC-2	IA-2$_{GPC-2}$	**To be able to** participate in the design of technical objects, systems and technological processes, taking into account environmental restrictions at all stages of the life cycle of technical objects and processes, including the stage of justification and selection of	**Is able to** participate in the design of technical objects, systems and technological processes, taking into account economic, environmental, social and other restrictions	Test

		technologies, design, construction, operation and end of the life cycle		
GPC-2	IA-3$_{GPC-2}$	**To master** designing technical facilities, systems and technological processes taking into account economic and environmental restrictions, including those established by the norms of Russian environmental legislation	**Masters** designing technical objects, systems and technological processes, taking into account economic, environmental, social and other restrictions	Test
GPC-6	IA-1$_{GPC-6}$	**To know** the ways of making well-founded technical decisions in professional activity, choosing effective and safe technical means and technologies that ensure the exclusion or minimization of negative impact on the environment and rational use of natural resources	**Knows** the ways of making well-founded technical decisions in professional activity, choosing effective and safe technical means and technologies	Test
GPC-6	IA-2$_{GPC-6}$	**To be able** to make well-founded technical decisions in professional activity, choose effective and safe technical means and technologies that ensure the elimination or minimization of negative impact on the environment and rational use of natural resources	**Is able** to make well-founded technical decisions in professional activity, choose effective and safe technical means and technologies	Test
GPC-6	IA-3$_{GPC-6}$	**To master the skills of** making well-found technical decisions in professional activity, choosing effective and safe technical means and technologies that ensure the elimination or minimization of negative impact on the environment and rational use of natural resources	**Masters** making well-founded technical decisions in professional activities, choosing effective and safe technical means and technologies	Test

3. Full time and forms of academic work

No.	Form of academic work	Hours in total	Distribution of hours
			7th semester
1	Holding classes (including results monitoring) in the form:	**45**	**45**
1.1	Contact classwork, including:	-	-
	- lectures (L)	16	16
	- laboratory work (LW)	-	-
	- practice, seminars and/or other seminar-type work (PW)	27	27
	- control of self-work (CSW)	2	2

	- test	-	-
1.2	Students' self-work (SSW)	**63**	**63**
2	Intermediate attestation	-	-
	Exam	-	-
	Grading test	-	-
	Test (Credit)	**9**	**9**
	Course Project (CP)	-	-
	Course Work (CW)	-	-
	Workload in hours	**108**	**108**

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
7^{th} semester				
General environmental issues	2	0	2	8
Population characteristics. Ecosystem structure. Food chains and networks. Bioaccumulation and bioconcentration in the food chain. Classification of environmental factors. Adaptations. Interactions				
Natural resources and anthropogenic impacts on the environment	2	0	2	8
Classification of natural resources. Resource depletion. Energy and resource saving. Alternative energy. Classification of pollution. Global environmental problems. Sustainable development. International cooperation				
Sanitary and hygienic regulation	2	0	3	8
Effects of pollutants on the human body. Synergy and antagonism of action. Accumulation. Sanitary-hygienic and ecological regulation. Maximum allowable concentration. Air pollution index, water pollution index. Standards of permissible emissions and discharges, standards of generation and limits for waste disposal				
Atmospheric air protection	2	0	4	8
Anthropogenic impact on atmospheric air. Priority pollutants and impacts. The consequences of air pollution. Smog. Cleaning of dust and gas emissions. Measures for the protection of atmospheric air. Methods, technologies and devices for cleaning dust and gas emissions				
Protection of water bodies	2	0	4	8
Anthropogenic impact on water bodies. Priority pollutants and impacts. The consequences of water pollution. Eutrophication. Wastewater treatment. Measures for the protection of water bodies. Methods, technologies and devices for wastewater treatment				

Soil protection and waste management	2	0	4	8
Anthropogenic impact on the lithosphere and soil. Depletion, erosion and pollution of soils. Fertilizers, pesticides, DDT. Waste management. General principles. Basic technologies. Use of resource potential				
Legal and economic mechanisms for ensuring environmental safety	2	0	4	8
Life cycle of man-made objects. Main steps. Presumption of environmental hazard. Environmental impact assessment and environmental expertise. Legal and economic aspects of environmental management. Environmental monitoring and control. Environmental economics. Environmental law. Environmental management and audit				
Regional and sectoral aspects of environmental safety	2	0	4	7
Regional aspects of environmental safety. Characteristics of the degree of pollution of atmospheric air, water bodies and lands of the Perm Territory. Specially protected objects of the Perm Territory. Sectoral aspects of environmental safety. Main environmental impacts and protection methods in selected industries				
Total with regard to the 7th semester	16	0	27	63
Total with regard to the course	16	0	27	63

Topics of exemplary practical work

Sl. №	Topic of practical (seminar) work
1	Population traits and food chains
2	Environmental factors
3	Natural resources, resource conservation
4	Environmental pollution. Global environmental problems
5	Impact of pollution on human health
6	Standardization of water quality and atmospheric air
7	Air pollution
8	Cleaning dust and gas emissions
9	Pollution of water bodies
10	Wastewater treatment
11	Pollution and protection of soil
12	Waste management
13	Life cycle of man-made objects
14	Legal and economic aspects of environmental management
15	Natural resources and environmental pollution in the Perm Territory
16	Sectoral aspects of environmental safety

5. Organizational and Pedagogical Conditions

5.1. Educational Technologies Used for Competences Formation

Holding lectures in the discipline is based on an active teaching method, in which students are

not passive listeners, but active participants in the lesson who answer the teacher's questions. The teacher's questions are aimed at enhancing the processes of mastering the material, as well as developing logical thinking. The teacher outlines in advance a list of questions that stimulate associative thinking and establishing links with previously mastered material.

Practical lessons are carried out on the basis of the implementation of the method of learning by doing: problem areas are identified, groups are formed. When conducting practical exercises, the following goals are pursued: application of knowledge of individual disciplines and creative methods for solving problems and making decisions; training students in teamwork skills, interpersonal communication and the development of leadership skills; consolidation of basic theoretical knowledge. Interactive lectures, group discussions, role-playing games, training sessions, and analysis of situations and simulation models are used in academic studies

5.2. Students' Manual for the Course Study

When studying the discipline, it is advisable for students to follow the recommendations:

1. The study of the discipline should be carried out systematically.
2. After studying a section using textbook or abstract materials, it is recommended to reproduce from memory the basic terms, definitions, concepts of the section.
3. Particular attention should be paid to the implementation of reports on practical exercises, laboratory work and individual complex tasks for independent work.
4. All topics of questions, studied independently, are set in lectures by the teacher. The teacher also gives sources (first of all, newly published in the periodical scientific literature) for a more detailed understanding of the issues voiced at the lecture.

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	F. Khabibrahmanova. Ecology: Some Problems of Environmental Pollution : study guide – Perm: Publishing house of PSTU, 2010.	150
2. Additional literature		
2.1. Educational and scientific literature		
1	B. Polozhintsev. Introduction to Ecology : [study guide] – Saint-Petersburg: Chimera, 1999.	1

6.2. Electronic Courseware

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet/local net; authorized free assess)
Additional literature	Fluides hydrauliques = Tcheliabinsk, 2011.	http://elib.pstu.ru/Record/lan9664	the local network
Additional literature	F. Khabibrahmanova Ecology: Some Problems	URL: https://elib.pstu.ru/Record/RUPN	the local network

	of Environmental Pollution. Perm: PSTU, 2010. 162 p.	RPUelib3074	

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

Type of Software	Software branding
Unified program for calculating atmospheric pollution	"Ecologist" (registration number 013572)
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 (license L3263-7820*)
General purpose application software	Microsoft Office Visio Professional 2016 (Azure Dev Tools for Teaching)
General purpose application software	WinRAR (license №879261.1493674)
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

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.lanbook.com/
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
Multimedia class	PC / laptop	1
	Projector	1
	Projection screen	1

8. Fund of the Course Evaluating Tools

Described in a separate document