Ministry of Science and Higher Education of the Russian Federation

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

APPROVED BY
Pro-rector for Academic Affairs
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ACADEMIC COURSE WORKING PROGRAM

Academic course: **Philosophical problems of science and technology**
(Name)

Form of education: **Full-time**
(Full-time /full-time - correspondence/correspondence)

Level of higher education: **Master's degree**
(Bachelor's program/specialist program/Master's program)

Workload in hours (in credits): **72(2)**
(Hours (CU))

Training program (degree): **38.04.01 Economics**
(Code and denomination of degree)

Direction: **Economics and management of oil and gas industries**
(Title of curriculum)

Perm 2021

1. General Provisions

1.1. Goals and Objectives of the Course

The goals of the course are:
- to introduce the main methodological and ideological problems arising at the present stage of science and technology development;
- to consider scientific and technical knowledge in a broad historical, philosophical, social and cultural context;
- to form systemic-theoretical awareness of the world as a whole for a deeper understanding of the essence of the scientific and technological revolution and related crisis situations;
- to master the skills of an engineer's responsibility for the fate of a man-made civilization.

In the process of learning the course **student should study** the history and trend of science and technology development, fundamentals of philosophical understanding of scientific problems, basic methodological principles underlying in social scientific perception, types of scientific rationality and peculiarity of modern scientific picture of the world, theoretical and empirical research methods, the role of philosophical cognition in interdisciplinary assessment of scientific and technological development, the role of science in the development of culture, the character of science-technology-society interaction**; obtain the ability** to make the comparison and give methodological assessment of this or that approach or theory in one's field of knowledge, to make difference between basic concepts and directions of philosophical cognition of science, engineering and technology at the different stages of their history, to make conceptual analysis and formation of ontological basis in the process of scientific and applied tasks solution, to analyze epistemological and social roots of different scientific, engineering and technological concepts, to examine scientific-technological projects from the positions of social engineering assessment**; master** conceptual apparatus of science and technology philosophy, fundamentals of scientific cognition methodology and systemic approach in the process of learning different levels of matter, information space and time organization, philosophical-methodological approaches necessary for correct understanding of essential aspects of scientific-technological and social-cultural development in the modern world, the skills of critical philosophical thinking based on the ability to scientific reflection, the skills of independent research work, the skills of implementing conscious moral choice in the process of realizing scientific-technological and innovative projects.

1.2. Prescribed Objects of the Course

Philosophic laws of science and technology development; ontological, epistemological and axiological basis of scientific-technological knowledge and knowledge of social science and humanities; philosophic laws of personality's formation in conditions of accelerated contradictory development of technogeneous civilization; responsibility ethics of scientist and engineer.

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 know how, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
UC-4	IA-1$_{\text{uc-1}}$	**To know** the methods of critical analysis and assessment of modern scientific achievements; the basic principles of	**Knows** the methods of problem situations solution in scientific-technological and production professional	Report

		critical analysis.	practice	
UC-1	IA-2.$_{uc-1}$	**To be able** to acquire knowledge on the basis of analysis, synthesis and, etc.; to collect data on the complex scientific problems related to professional sphere; to search information and to make decisions on the basis of actions, experiments and experience	**Is able** to acquire knowledge on the basis of systemic approach; to analyze critically the data on complex scientific problems related to professional sphere; to search for solutions on the basis of scientific methodology.	Colloquium
UC-1	IA-3.$_{uc-1}$	**To master** the skills of critical analysis and assessment of modern scientific achievements; basic principles of critical analysis, synthesis and etc.; the skills of gathering data on complex scientific problems related to professional sphere; the skills of information acquisition and making decisions on the basis of actions, experiments and experience; the skills of examination the problem of professional activity by the application of analysis, synthesis and other methods of intellectual activity; the skills of revealing scientific problems and using appropriate methods for their solution; the skills of value judgement in the process of problem professional situations solution.	**Masters the skills of** prognostic activity making possible to construct the strategy of research and practical decisions; heuristic analysis of promising trends of science and technology; strategic planning in different fields of professional activity.	Colloquium
UC-6	IA-1.$_{uc-6}$	**To know** basic principles of self-education, professional and personal development reasoning from the career growth and market demands; principles of self-organization, self-development and health protection.	**Knows** specifics of organizational and managerial decision making; theoretical and methodological fundamentals of self-development, self-realization, use of creative potential of one's own activity; basic scientific schools of psychology and management; activity approach to the personal development research; technology and methods	Individual tasks

			of self-assessment; theoretical basis of acmeology	
UC-6	IA-2.uc-6	**To be able to** plan working time and time for self-development; to state the goals of personal and professional development and conditions of their achievement reasoning from the trends of professional activity sphere, personality characteristics.	**Is able to** determine priorities of professional activity and methods of its improvement on the base of self-assessment; develop, control, assess and examine the components of professional activity; plan independent activity in the process of professional tasks solution.	Grading test
UC-6	IA-3.uc-6	**Masters the skills of** getting additional education, learning extra educational programs.	**Masters the skills of** determining efficient actions in the field of professional activity; making decisions in one's own professional activity; planning of one's own professional activity.	Discussion

3. Full time and forms of academic work

Form of academic work	Hours in all	Distribution in hours according to semesters		
		Number of semester		
		2		
1. Holding classes (including results monitoring) in the form: 1.1.Contact classwork, including:	29	29		
- lectures (L)	9	9		
- laboratory work (LW)				
- practice, seminars and/or other seminar-type work (PW)	18	18		
- control of self-work (CSW)	2	2		
- test				
1.2. Students' self-work (SSW)	43	43		
2. Intermediate attestation				
Exam				
Grading test	9	9		
Test (Credit)				
Course Project (CP)				
Course Work (CW)				
Workload	72	72		

4. Course outline

Name of the units with the course outline	Full time of classroom	Full time of

	activity in hours according to the forms			extracurricular work in hours according to the forms
	L	LW	PW	SSW
2nd semester				
Introduction. Basic definitions of the course "Philosophical problems of science and technology"	1	0	2	3
Goals and objectives of the course. Three aspects of science being: science as cognitive activity, as a social institute, as a special sphere of culture. Modern philosophy of science as learning of general regularities of scientific cognition in its historical development. The problem of science, technology and society relationship in historical-philosophical outlook.				
Ancient philosophy in its relation to science	1	0	2	7
Pre-science and science in the proper sense of the word. Two strategies of knowledge generation; summarizing of practical experience and construction of theoretical models providing moving beyond the limits of historically existing forms of production and everyday experience. Ancient logics and mathematics. Techne and ancient science. Medieval Christian philosophy in its relation to science. Competition of realism, nominalism and conceptualism in scholasticism. Development of logical norms of scientific thinking and organization of science in medieval universities. Appearance of mathematized experimental natural science in New time. New-European empiricism and rationalism (F. Bacon, R. Descartes). Knowledge (cognition) as the problem of philosophy (Kant, Hegel, Marxists and others). Social cultural premises of experimental method origin and its combination with mathematical description of nature. Technological application of science. Role of technology in formation of experimental science in New-European culture.				
Structure of empirical and theoretical knowledge.	1	0	2	3
Empirical and theoretical levels, criteria of their difference. Peculiarities of empiric and theoretical languages of science. Experiment and observation. Procedures of the fact formation. Problem of theoretical loading of the fact. Theoretical models as the element of internal science organization. Hypothesis vs axiom. Role of constructive methods in deductive development of theory. Mathematizing theoretical knowledge. Logic and methodology of science. Methods of scientific cognition and their classification. Analysis of methodological concepts mostly influencing the development of scientific programs from Ancient times till the present. Classification of methods (philosophical, general scientific, specific scientific, interdisciplinary, transdisciplinary, formal, heuristic methods, etc.) Correlation of natural-scientific knowledge and knowledge of humanities. Methodological analysis of technical sciences. Connection of classical technical sciences and natural sciences. Fundamental and applied research in technical sciences; concept of technical theory. Structure of technical theory. Three types of theoretical schemes in the structure of technical theory (functional, procedural, structural). Difference of non-classic scientific-technological disciplines and methods from classical technical				

sciences. Sciences of designing and engineering activity. Understanding with the help of "doing". Mathematical modelling in technical sciences and engineering work. Specifics of engineering methods at the modern stage of scientific-technological development.				
Scientific revolutions and types of scientific rationality.	2	0	6	14
Interaction of traditions and appearance of new knowledge. Scientific revolutions as reconstruction of scientific fundamentals. Scientific revolutions as the point of bifurcation in the development of knowledge development. Global revolutions and types of scientific rationality. Evolutionary-synergetic paradigm of modern science. Formation of synergetic paradigm. Categorical frame of synergy. Philosophical-methodological analysis of synergy. Concept of global evolutionism. Scientific research and extra scientific values. Scientific picture of the world. Philosophical base of science. Historical variability of the mechanism of scientific knowledge generation. Scientific pictures of the world in social-cultural measurement. Philosophical base of scientific pictures of the world. Role of philosophic ideas and principles in substantiation of scientific knowledge. Philosophy as a generation of categorical structures necessary for mastering new types of system objects. Scientific pictures of the world and structure of matter. Development of structure of matter concepts and modern physics. Physical picture of the world. Structural levels of matter organization. Universe evolution. Formation and development of the biological picture of the world. Personal development. Sciences of human and society.				
Philosophy of technology becoming and development	4	0	6	16
Philosophy of technology becoming (E Kapp, F. Bon, A. Espinosa, P.K.Engelmeyer). P.K.Engelmeyer as the founder of the native philosophy of technology. "Engineering" and "Humanitarian" philosophy of technology. Philosophers of the 20th century about engineering and scientific-technological development. Modern analytical philosophy of technology. The problem of science and technology relationship. Concept of sustainable development in the context of forming a new scientific-technological development paradigm. Technoscience and NBICS-technologies. Technoscience as a new stage of development and principle of modern science organization. Interrelation of fundamental knowledge and technological projects of science. Ontological and epistemological basis of technoscience. NBICS-technologies and the problem of convergence character of modern science and technology development. Ecological and social-economic expertise of scientific-technological projects. Social technology assessment as applied philosophy of technology. Approaching ideals of scientific-technological and social-humanitarian cognition. New ethic problems of industrial civilization. Problems of social control in technoscience and high technologies. Ecological and ethical				

expertise of scientific-technological projects. Problem of engineering education humanitarization. Concept of humanitarization of engineering education: philosophical-methodological analysis. Technological ethics. Ethics of responsibility in the epoch of "high technologies				
Total with regard to semester	9	0	18	43
Total with regard to the course	9	0	18	43

Topics of exemplary practical work

Sl. №	Topic of practical work (seminars)
1	Analysis of categorical framework of the discipline.
2	Classification of sciences and specifics of scientific cognition.
3	Aristotelian vs Galilean science (comparative analysis). .
4	Social-cultural premises of experimental method appearance and its connection with mathematical description of nature.
5	Problem of method in the works of F. Bacon and R Descartes (comparative analysis. Induction and deduction.
6	Universal and special scientific methods. Role of mathematics in modern scientific-technological research.
7	Interpretation of the Copernican revolution in the works of K. Popper and T. Kun.
8	Evolutionary-synergetic paradigm of modern science.
9	Concept of sustainable development in the context of forming a new scientific-technological paradigm.
10	Social-humanitarian assessment of scientific-technological projects. Concept of humanitarization of engineering education in PNRPU.

Topics of exemplary laboratory practice

Sl. №	Topic of laboratory work
	Unstipulated

5. Organizational and Pedagogical Conditions

5.1. Educational Technologies Used for Competences Formation

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 hold 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.

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

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	Macmillan Guide to Science : Student's Book / Kozharskaya E., McNichoplas K., Bandis A., Konstantinova N. Oxford : Macmillan Publ. Ltd, 2008. 127 p.	1
2		
2. Additional literature		
2.1. Educational and scientific literature		
1	Brown R.K. Understanding industrial organizations: Theoretical perspectives in industrial sociology / R. K. Brown. - London; New York: Routledge, 1992.	1
2	Davis J.B. The Theory of the Individual in Economics: Identity and value / J.B .Davis. London; Ney York: Routledge, 2003.	1
3	The Foundations of Analytic Philosophy / Ed. by P. A. French. Minneapolis : Univ. of Minnesota Press, 1981. 529 p.	1
4	English in Science and Technology : Lehrmaterial fur die Sprachkundigenausbildung Stufe II a / . Leipzig : VEB Verl. Enzyklopädie, 1982. 230 p.	2
5	An Introductory Text to Bioengineering / Chim S., Fung Y.-C. B., Huang W., Kerckhoffs R. C. P. New Jersey : World Scientific, 2008. 542 p.	1
6	Intelligent Data Analysis in the Management of Production Systems (Approaches and Methods) / Mylnikov L., Krause B., Kuetz M., Bade K. Aachen : Shaker Verlag, 2018. 179 p.	1
2.2. Standardized and Technical literature		
	unstipulated	
3. Students' manual in mastering discipline		
1.		
2.		
3.		
4.		

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	Vagler Ch. An introduction to philosophy.N. Novgorod, 2017.	URL: https://elib.pstu.ru/Record/lanRU-LAN-BOOK-153004	local net; authorized free access
Basic literature	Khramova K.V. History and theory of philosophy. Ufa, 2020	URL: https://elib.pstu.ru/Record/lanRU-LAN-BOOK-155788	local net; 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 (license L3263-7820*)
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

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.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
Lecture	notebook	1
Practical lesson	notebook	1

8. Fund of the Course Evaluating Tools

Described in a separate document