

Module Description

1. COURSE Name

Philosophy of natural, humanitarian and technical sciences

2. Total number of hours, credits

126 hours, 3.5 credits

3. Distribution of hours

18 hours of lectures, 54 hours of practical classes, 54 hours of independent work (18 weeks, 2*45 minutes of lectures once per two weeks, 2*45minutes of practical classes per first week and 4*45 minutes of practical classes per second week)

4. Department

Department of Sociology, Irkutsk State Technical University

5. Type

Compulsory

6. Prerequisites

Course “Philosophy”

Course “History of science”

Course “Culture studies”

Course “Logic”

7. Instructors

Person of charge: Professor Alla A. Kuzmichieva,

Others:-

8. Person responsible for module

Professor Alla A. Kuzmichieva,.

9. General goals

“Philosophy of natural, humanitarian and technical sciences” is one of the major disciplines. The principle goal of the course is to strengthen the theoretical background of the concerned master degree students, develop their scientific world view and provide them with comprehension of research methodology. The course will also address the philosophical issues of logic-mathematical, natural (physics, chemistry, biology), social and humanitarian (linguistics, anthropology, sociology, economics) and technical sciences (computer and information science). The course program represents the basic complex of philosophical aspects of specific sciences of 20-21 centuries and thus discovers the dialectic logic of science development and unity.

10. Specific goals | learning outcomes

Knowledges

- ✓ Philosophy (ontology and epistemology) of science as a subject;
- ✓ History and sociology of science, scientific activity economics, organization and management;
- ✓ Structure of scientific knowledge and science classification, basic concepts of philosophy of science;
- ✓ Peculiarities of methods of natural, humanitarian and technical sciences; structure and system of scientific cognition and knowledge;
- ✓ Science in anthropogenic civilization, basic features of scientific knowledge.

Abilities

- ✓ to master the methodology of research program working out and scientific research carrying out,
- ✓ to master the methodology of scientific publication preparation.

Competences

- ✓ to acquire the skills of scientific research carrying out and practical use of these skills by master thesis preparation.

11. Course contents

Lecture content (18 hours)

Lecture 1. Science and scientific worldview (2 lecture hours)

- 1.1 “Philosophy of natural, human and technical sciences” as an academic discipline
- 1.2. Concept of science and scientific world-view
- 1.3. Grounds and criteria of science classification.
- 1.4. Science development periodization.
- 1.5. Basic concepts of contemporary philosophy of science

Lecture 2. Science and society (2 lecture hours)

- 2.1. Specific character of science as a form of intellectual culture.
- 2.2. Difference of science from other forms of public conscience and areas of human activity.
- 2.3. Science and pseudo science.
- 2.4. Common human practical activity as a purpose, source, driving force of development, criterion of utility and adequacy of science

Lecture 3. Ontology of scientific theory (2 lecture hours)

- 3.1. World as an objective reality and its structure
- 3.2. Attribute “material” as a general scientific category
- 3.3. Other attributes of the world as general scientific categories
- 3.4. Existence as an attribute of the world and ontological assumptions in science

- 3.5. Relations, connection, change, motion, interaction in science
- 3.6. Space
- 3.7. Genesis and development of concepts about time as a general scientific category
- 3.8. World as everywhere dense space-time diversity of things

Lectures 4 and 5. Ontology of specific sciences (4 lecture hours)

- 4.1. Concept of virtuality and multiplication of worlds of scientific theory
- 4.2. Ontology of logic and mathematical sciences
- 4.3. Ontology of natural science
- 4.4. Ontology of social and humanitarian sciences
- 4.5. Ontology of technical sciences
- 4.6. Ontological problems of information sciences

Lecture 6. Scientific cognition: its levels, forms and methods (2 lecture hours)

- 6.1. Peculiarities of scientific cognition and scientific knowledge.
- 6.2. Forms of human scientific reflection of the world (sensual, rational, intellectual). Role of memory.
- 6.3. Language of science
- 6.4. Presentation of reality in theory
- 6.5. Scientific method and methodology of science
- 6.6. Role of intuition in scientific work

Lecture 7. Evolution of scientific cognition. Scientific knowledge theorization (2 lecture hours)

- 7.1. Pre-science and science
- 7.2. Ideals and principles of antique, scholastic and classical science
- 7.3. Normal science and scientific revolution
- 7.4. Scientific truth and scientific theory. Accurate and approximate, probable and certain, synthetic and analytical knowledge. Consistency
- 7.5. Contemporary methods of scientific cognition and representation of scientific knowledge
- 7.6. Scientific theory and stages of its development

Lecture 8. Methodology of logic-mathematical and natural theories (2 lecture hours)

- 8.1. Role of modeling method in scientific cognition
- 8.2. Peculiarities of logic-mathematical methods. Exact theory.
- 8.3. Empirical methods and mathematization of natural sciences
- 8.4. Formalization of empirical theories

Lecture 9. Methodology of socio-humanitarian and technical theories (2 lecture hours)

- 9.1. Specificity of social and humanitarian methods
- 9.2. Methodology of engineering activity.

9.3. Methodology of computer science.

Practical classes (54 hours)

#	Topic	duration	
		seminar	self study
1.	1. Science and scientific worldview 1.1. “Philosophy of natural, human and technical sciences” as an academic discipline. Science of science and philosophy of science. 1.2. Concept of science and scientific worldview. Ordinary and scientific picture of the world. Criteria of scientific content. 1.3. Science as a form of public conscience and area of human activity. 1.4. Difference of science from other forms of public conscience and areas of human activity.	2 hours/ 90 minutes	2 hours/ 90 minutes
2.	2. Science classification and periodization 2.1. Background and criteria of science classification. 2.2. Science development periodization: pre-science and science, regular science and scientific revolution. Classical, non-classical and post-non-classic stages of science development. 2.3. Basic concepts of contemporary philosophy of science: H. Poincare, B. Russell, L. Wittgenstein, R. Carnap, A. Tarski. 2.4. Basic concepts of contemporary philosophy of science (second part of the 20 th century): W.V.O. Quine, K. Popper, I. Lacatos, T. Kuhn, P. Feyerabend, M. Polanyi.	2 hours/ 90 minutes	2 hours/ 90 minutes
3.	3. Science and society 3.1. Science as a form of intellectual production and social institution. Role of science in the society. 3.2. Science and morality 3.3. Science and power 3.4. Science and religion 3.5. Philosophy and specific sciences	2 hours/ 90 minutes	2 hours/ 90 minutes
4.	4. Science and practice 4.1. Doctrines about practice in the history of science 4.2. Universal practical activity as objective, source, factor of science development. 4.3. Interscientific sources of science development. 4.4. Practice as a criterion of scientific knowledge utility and adequacy.	2 hours/ 90 minutes	2 hours/ 90 minutes
5.	5. Ontological problems in philosophy of science 5.1. Objective reality and ontology of theory 5.2. Optimum set of general scientific categories in the ontology of theory 5.3. Criterion attribute of objective reality and its role in science 5.4. Ideal entities and their existence 5.5. Role of categories of relation, connection, interaction, change in the ontology of theory 5.6. Role of space and time in the ontology of theory 5.7. Scientific picture of the world, virtuality and scientific theory	2 hours/ 90 minutes	2 hours/ 90 minutes
6.	6. Ontology of logic	2 hours/	2 hours/

	6.1. Logic as a science. 6.2. Ontology of Aristotle logic 6.3. Logic mathematization. Logic deontologization. 6.4. Contemporary logic 6.5. Science history and logic	90 minutes	90 minutes
7.	7. Ontology of mathematics 7.1. Nature of mathematical knowledge. Virtual model and interpretation 7.2. Peculiarities of geometric knowledge. Euclid and Descartes 7.3. Structure and classification of mathematical theories 7.4. Philosophy of mathematics: R. Descartes, I. Newton, G. Berkeley, G.W. Leibniz, I. Kant, B. Russell, L. Wittgenstein, V.V. O. Quine	2 hours/ 90 minutes	2 hours/ 90 nute s
8	8. Ontology of natural sciences 8.1. Ontology of mechanics and physics. Objects and forces. Fields and particles. Causality. Energy. Physical picture of the world. 8.2. Chemical picture of the world and chemical elements systematization. Chemical bonds and reductionism. 8.3. Essence and origin of life. Gene as replicator 8.4. Philosophy of synergy. Evolutionism	2 hours/ 90 minutes	2 hours/ 90 minutes
9.	9. Ontology of social and humanitarian sciences 9.1. Dialectics of biological and social in anthropogenesis 9.2. Being, non-being and other being of people in religion 9.3. Society and its ontology in social and human pictures of the world. 9.4. Concept of human vital world. 9.5. Ontology of economics 9.6. Ontology of gender	2 hours/ 90 minutes	2 hours/ 90 nute s
10	10. Ontology of technical knowledge 10.1. World "Techne": artificial things (devices) and skillful technologists 10.2. Social and human background of technical things and technologies 10.3. Polyonticity of technical picture of the world 10.4. Types of modeling and forms of models in technical sciences 10.5. Function-morphological approach in construction of material patterns and design of cognitive models	4 hours/ 180 minutes	4 hours/ 180 minutes
11.	11. Cybernetic picture of the world 11.1. Specificity of cybernetic picture of the world 11.2. Object domain in cybernetics and are of its application 11.3. Model and interpretation 11.4. Typology of cybernetic models	2 hours/ 90 minutes	2 hours/ 90 minutes
12.	12. Ontological problems of computer sciences 12.1. History of informatics as a science. Information picture of the world 12.2. Hardware and software world 12.3. Information and its encoding. Digital codes 12.4. Programmer as a creator of virtual worlds 12.5. Essence and importance of networks and communications in technology	2 hours/ 90 minutes	2 hours/ 90 minutes
13.	13. Forms of human scientific reflection of the world. Role of	2 hours/	2 hours/

	<p>memory.</p> <p>13.1. Knowledge and faith. Scientific probability vs. religious absolutism</p> <p>13.2. Human being as a subject of scientific reflection of the world. Anthro- and sociomorphism of knowledge. Agnosticism and science. Continuity of knowledge</p> <p>13.3. Evolutionary psychology as a science</p> <p>13.4. Role of sensual and emotional in scientific cognition</p> <p>13.5. Connection of rational and intellectual in science</p> <p>13.6. Theory and its subject area. Description of scientific facts and comprehension of scientific laws</p>	90 minutes	90 minutes
14.	<p>14. Language of science</p> <p>14.1. Essence and forms of human ideal reflection of the world, their material medium.</p> <p>14.2. Sign and designatum. Idea and word</p> <p>14.3. Language and objective reality. Process of naming of things, their properties and relations. Linguistic picture of the world.</p> <p>14.4. Natural and artificial languages.</p> <p>14.5. Methodological requirements to artificial language: accuracy, ease, monosemantisity, and isomorphism.</p> <p>14.6. Machine languages. The necessity of language forms mathematization. Numerical languages. Choice of numerical system.</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
15.	<p>15. Contemporary methods of scientific cognition and scientific knowledge representation.</p> <p>15.1. Role of a method in science and reasons of scientific delusions</p> <p>15.2. Methodology and principles of scientific cognition</p> <p>15.3. General scientific approaches</p> <p>15.4. General scientific methods: generalization, abstraction, definition, analysis and synthesis, induction and deduction, classification, analogy, description and explanation, cognition</p> <p>15.5. Model, model approach and modeling method</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
16.	<p>16. Methods of empirical research</p> <p>16.1. Observation and experiment</p> <p>16.2. Measurement</p> <p>16.3. Description, comparison and classification</p> <p>16.4. Empirical and theoretical, real and virtual in empirical theories</p> <p>16.5. Peculiarities and methodology of engineering creative work</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
17.	<p>17. Methods of theoretical research</p> <p>17.1. Role of explanation and cognition in theory</p> <p>17.2. Abstracting</p> <p>17.3. Mental experiment and modeling</p> <p>17.4. Hypothetical-deductive method</p> <p>17.5. Method of axiomatization and formalization</p> <p>17.6. “Digitalization”, method of information computerization</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
18.	<p>18. Forms and stages of scientific theories construction</p> <p>18.1. Realization of necessity of theory construction. Selection of its place in science system and form</p> <p>18.2. Problem formulating. Statement of research objective and tasks</p> <p>18.3. Collection of empirical material (observation, modeling,</p>	4 hours/ 180 minutes	4 hours/ 180 minutes

	<p>experiment).</p> <p>18.4. Hypothesis generation</p> <p>18.5. Substantiation of hypothesis: corroboration or refutation</p> <p>18.6. Concept generation, theory construction</p> <p>18.7. Goedel paradox and theory change</p>		
19.	<p>19. Nature and forms of scientific truths</p> <p>19.1. Concept and ontology of scientific truth.</p> <p>19.2. Dichotomy of scientific truths</p> <p>19.3. Logic and mathematical truths and their criteria</p> <p>19.4. Empirical truths and their criteria</p> <p>19.5. Peculiarities of humanitarian truths</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
20.	<p>20. Scientific values. Axiology of science</p> <p>20.1. Human values and science</p> <p>20.2. Scientific ideals</p> <p>20.3. Types of assessment of scientific statements</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
21.	<p>21. Methodology of logic and mathematics</p> <p>21.1. Essence of exact theories</p> <p>21.2. Procedural character of exact theories</p> <p>21.3. Peculiarities of logic methods</p> <p>21.4. Structure of formalized and formal mathematical theory</p> <p>21.5. Peculiarities of mathematical methods. Mental experiment</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
22.	<p>22. Methodology of natural sciences</p> <p>22.1. Empirical methods in natural sciences (by the example of chemistry)</p> <p>22.2. Formalization of empirical theories</p> <p>22.3. Essence, reasons and limits of mathematization of natural sciences</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
23.	<p>23. Epistemology of social and humanitarian knowledge</p> <p>23.1. Specificity of social and humanitarian cognition and its methodology</p> <p>23.2. Problem of objective character of cognition in social and humanitarian sciences</p> <p>23.3. Conceptual framework of social and humanitarian theories</p> <p>23.4. Logic sociology by Zinoviev A.A.</p> <p>23.5.</p> <p>23.6. Basic methodological approaches in technical theories</p> <p>23.7. Methodology of design and construction in engineering activity</p> <p>23.8. Methodological foundations of theory of theory of inventive problem solving (TRIZ)</p> <p>23.9. Epistemology of cybernetic sciences</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
24.	<p>24. Epistemology of technical knowledge</p> <p>24.1. Basic methodological approaches in technical theories</p> <p>24.2. Theorization of technical knowledge</p> <p>24.3. Methodology of design and construction in engineering activity</p> <p>24.4. Role of intuition in technical creative work</p> <p>24.5. Methodological foundations of the theory of decision of inventive tasks</p>	2 hours/ 90 minutes	2 hours/ 90 minutes
25.	<p>25. Epistemology of cybernetics and informatics</p> <p>25.1. Hard- and soft technologies in computer sciences</p> <p>25.2. Methodology of programming</p>	2 hours/ 90 minutes	2 hours/ 90 minutes

25.3. Role of language and linguistic technologies in informatics		
25.4. Essence and importance of networks and communications in technology		
	54 hours / 2430 minutes	54 hours / 2430 minutes

12. Evaluation Methodology

Final grade: $0.4 * T1 + 0.3 * T2 + 0.3 * T3$

T1 – average grade for seminars

T2 – average grade for independent work (essays)

T3 – final examination

13. Basic Bibliography

1. История и философия науки. Под ред. А.С. Мамзина, М.-СПб: Питер, 2008 // History and philosophy of science. Edited by A.S. Mamzina, M. - S-Pb: Piter, 2008
2. Петров Ю.П. История и философия науки. Математика, вычислительная техника, информатика. СПб., 2005 // Petrov Yu.P. History and philosophy of science. Mathematics, computer science, information science. S-Pb., 2005
3. Современные философские проблемы естественных, технических и социально-гуманитарных наук Миронов В.В.(ред.) М.: Гардарики, 2006. — 639 с // Contemporary philosophical issues of natural, technical and social and humanitarian sciences. Edited by V.V. Mironov. M.: Gardariki, 2006
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14. Complementary Bibliography

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 15. Декарт Р. Рассуждение о методе. М., 1988 // Descartes R. Discourse on method. М., 1988
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