СИБИРСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ
SIBERIAN FEDERAL UNIVERSITY

History and Philosophy of Science

Course Guide

Krasnoyarsk, 2020.

Siberian Federal University

History and Philosophy of Science

Course Guide

This course contributes to the requirements for the Degree of Candidate of Science in Computer Science.

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Contents

1. Course Description

This course contributes to the requirements for the Degree of Candidate of Science in Computer Science

Course period	2 semesters First semester: from October, the 1st to February, the 1st (18 weeks) Second semester: from February, the 1st to June, the 1st (18 weeks)
Study credits	3 ECTS credits
Duration	108 hours
Language of instruction	English
Academic requirements	– MSc degree in Computer Science or equivalent (transcript of records), – good command of English (certificate or other official document)

1.1 Course overview

The subject of philosophy of science is the analysis of theoretical, cognitive and methodological grounds of modern scientific knowledge.

Currently scientific knowledge is analyzed in its logical, epistemological and socio-cultural aspects.

1.2 Special features

The course presents philosophical understanding of science as a system of knowledge, human activity and a social institution. The course covers general tendencies of science history, methodology of scientific cognition, the role of science in society and a number of related issues. A special part of the course is devoted to basic philosophical dispositions influencing how the modern science image is shaped in the mind of the public. The course is aimed at demonstrating the state of modern science in its inextricable link with its history.

1.3 Course aims and objectives

Course Aims

The aim of the course is to provide the general background of history and philosophy of science and to prepare students for their postgraduate exams as well as to give knowledge adequate to the current state of development of this scientific discipline and to help shape students into competent researchers and educators in the field of philosophy of science.

Course Objectives

The objective of the course is to gain knowledge of general problems of history and philosophy of science as well as philosophical problems of students' field of postgraduate study. The course presents philosophical understanding of science as a system of knowledge, human activity and a social institution. The course covers general tendencies of science history, methodology of scientific cognition, the role of science in society and a number of related issues.

A special part of the course is devoted to basic philosophical dispositions influencing how the modern science image is shaped in the mind of the public. The course is aimed at demonstrating the state of modern science in its inextricable link with its history.

1.4 Learning outcomes

After completing the course students should be able to use the philosophical study methods applied to science, to do scientific research according to all principles of scientific ethic and personal responsibility for the aims, means and results of scientific work.

2. Course Lecturer, Contact Information

Viacheslav Kudashov,
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Siberian Federal University
e-mail: vkudashov@mail.ru
Google Scholar page:
https://scholar.google.com/citations?user=_f-hGzYAAAAJ&hl=en
Additional information is available at:
https://structure.sfu-kras.ru/node/1269

3. Prerequisites

A background in courses of history and philosophy will help in faster and better understanding of every topic. Nevertheless, each part of the course includes a short introduction of methods that are required for its study. Therefore, a student without the denoted experience must be encouraged to make some additional efforts in education.

4. Course Outline

Week	Lectures/Seminars/ Assignments	Hours
Semester 1		
1-9	Module 1. General problems of the philosophy of science	36
Semester 2		
10-24	Module 2. Modern philosophical problems of the branches of scientific knowledge	72
36	**Final Exam**	**36**

4.1 Course requirements

4.1.1 Web-page of the course

Course materials and required reading materials are available on the course webpage “History and Philosophy of Science”. The webpage is available through the SibFU E-learning portal www.e.sfu-kras.ru. You must be logged in to access this course https://e.sfu-kras.ru/enrol/index.php?id=1502.

4.1.2 Required reading

Core Reading

1.1. History and Philosophy of Science: A guide for graduate students and applicants / executive editor V.I.Kudashov. Krasnoyarsk: SFU, 2012 - 386 p.

1.2. History and Philosophy of Science. Common problems of the philosophy of science: studies. Manual / V.P. Konev, E.I. Petrov, P.G. Gusev. - Novosibirsk, 2009 - 198 p.

1.3. Lebedev, S.A., Rubochkin, V.A. The history of science philosophical and methodological analysis: a textbook for high schools / S.A. Lebedev, V.A. Rubochkin. - Moscow, 2011 - 351 p.

1.4. Ustyugov, V.A. The history of science. Manual / V.A. Ustyugov.- Krasnoyarsk: SFU, 2011 - 104 p.

Additional Reading

2.1. Almeder, R. Pragmatism and philosophy of science: A critical survey // Intern. studies in the philosophy of science. - Basingstoke, 2007. - Vol. 21, N 2. - P. 171-195.

2.2. Andersen H., Barker P., Chen Xiang. Kuhn's mature philosophy of science and cognitive psychology // Philos. psychology. L., 1996. Vol. 9, N 3. P. 347-363.

2.3. Babich B.E. Against postmodernism and the "new" philosophy of science:

2.4. Bajaj, J.K. Francis Bacon, the first philosopher of modern science: a non- western view // Science, hegemony and violence. - Tokyo, 1988. - P. 24-67.

2.5. Bird A. Philosophy of science // Fundamentals of philosophy. - L.; N.Y., 2003. - P. 297-325.

2.6. Blackmore J.T. A new conception of epistemology and its relation to the methodology and philosophy of science // Methodology a. science. - Haarlem, 1981. - vol. 14, N 2. - p. 95-126.

2.7. Chalmers A.F. What is this thing called science. St Lucia, Qld. : University of Queensland Press, 1999. xxii, 266 p.

2.8. Clark A. Mindware: An Introduction to the Philosophy of Cognitive Science. New York: Oxford University Press, 2001. 224 p.

2.9. Contemporary Debates in Philosophy of Science // ed. by C. Hitchcock. Oxford: Wiley-Blackwell 2004. 368 p.

2.10. Chignell A. Neo-kantian philosophies of science: Cassirer, Kuhn, and Friedman // Philos. forum. N.Y., 2008. Vol. 39, N 2. P. 253-262.

2.11. Contemporary Debates in Philosophy of Science // ed. by C. Hitchcock. Oxford: Wiley-Blackwell 2004. 368 p.

2.12. Couvalis G. The Philosophy of Science: Science and Objectivity. London: SAGE, 1997. 206 p.

2.13. DeWitt R. Worldviews: An Introduction to the History and Philosophy of Science. Chichester, UK: Wiley-Blackwell, 2010. 392 p.

2.14. Hackett J. Roger Bacon's concept of experience: a new begining in medieval philosophy? // Mod. schoolman. - Saint Louis, 2009. Vol. 86, N 1/2. P. 123-146.

2.15. Haines V.A.Spencer's philosophy of science // Brit. j. of sociology. L., 1992. Vol. 43, N 2. P. 155-172.

2.16. Handbook of the Philosophy of Information // D.M. Gabbay, P. Thagard, J. Woods, P. Adriaans, F.A.K. Johan van Benthem. North Holland, Elsevier, 2008. 1000 p.

2.17. Horwich, P. Wittgensteinian Bayesianism // Midwest studies in philosophy. Notre Dame (Ind.), 1993. Vol. 18. P. 62-77.

2.18. Hoyningen-Huene, P. Reconstructing scientific revolutions: Thomas S. Kuhn's philosophy of science / Transl. by Levine A.T., With a forew. by Kuhn Th. Chicago ; L.: The univ. of Chicago press, 1993. XX, 310 p.

2.19. Fehr C., Plaisance K.S. Socially relevant philosophy of science: an introduction // Synthese. Dordrecht, 2010. Vol. 177, N 3. P. 301-316.

2.20. Foucault across the disciplines. L. etc., 2011. N 4. 123 p.

2.21. Friedman M. Philosophy and the exact sciences: Logical positivism as a case study // Inference, explanation, and other frustrations. - Berkeley etc., 1992. - P. 84-98.

2.22. Godfrey-Smith P. Theory and Reality: An Introduction to the Philosophy of Science. Chicago: University of Chicago Press. 2003. 288 p.

2.23. Introductory readings in the philosophy of science / Ed. by Klemke E. D. et al. - Buffalo (N.Y.): Prometheus books, 1980.

2.24. Karl Popper: Philosophy a. problems / Ed. by O'Hear A. - Cambridge etc.: Cambridge univ. press, 1995. IV, 297 p.

2.25. Koertge, N. "New age" philosophies of science: constructivism, feminism and postmodernism // Brit. j. for the philosophy of science. Aberdeen, 2000. Vol. 51, P. 667-683.

2.26. Ladyman J. Understanding Philosophy of Science. London: Routledge. 2002. 290 p.

2.27. Losee J. A Historical Introduction to the Philosophy of Science (OPUS). Oxford: Oxford University Press. 2001. 328 p.

2.28. McMullin, E. The impact of Newton's "Principia" on the philosophy of science // Philosophy of science. - Bloomington (IN), 2001. - Vol. 68, N 3. - P. 279-310

2.29. Mulkay M., Gilbert G.N. Putting philosophy to work: Karl Popper's influence on scientific practice // Philosophy of the social sciences. - Waterloo, 1981. - vol. 11, N 3. - p. 389-407.

2.30. Nickles Th. Introductory essay: Scientific discovery and the future of philosophy of science // Scientific discovery, logic and rationality. - Dordrecht etc.:Reidel, 1980. - p. 1-59.

2.31. Okasha S. Philosophy of Science: A Very Short Introduction. Oxford University Press. 2002.

2.32. Pinto de Oliveira, Carnap J.C. Kuhn, and revisionism: on the publication of "structure" in " encyclopedia" // Ztschr. fur allgem. Wissenschaftstheorie = J. for gen. philosophy of science. - Stuttgart, 2007. - Bd 38, H. 1. - P. 147-155.

2.33. Papineau D. Methodology: the elements of philosophy of science / in A.C. Grayling, ed., Philosophy 1: A Guide through the Subject. Oxford: Oxford University Press, 1998. P. 125-180.

2.34. Philosophy of Science: An Historical Anthology // eds. by McGrew T., Alspector-Kelly M., Allhoff F. Chichester, UK; Malden, MA: Wiley-Blackwell. 2009. xix + 660 p.

2.35. Psillos S. Philosophy of Science A-Z. Edinburgh University Press, 2007.

2.36. Richardson A. Robert K. Merton and philosophy of science // Social studies of science. - L., 2004. - Vol. 34, N 6. - P. 855-858.

2.37. Rosenberg A. Philosophy of Science: A Contemporary Introduction. Routledge, London, 2000. 191 p.

2.38. Ruttkamp, E. The role of "models" in philosophy of science: Mediating betweenthegeneral and the "particular" // Images and reality : Proc. of the 1996 Miskolc conf. - Miskolc, 1997. - P. 127-146.

2.39. The Routledge companion to philosophy of science / Ed. by Psillos S., Curd M. L. ; N.Y.: Routledge, 2008. - XXVII, 619 p.

2.40. Salmon W. Scientific Explanation and the Causal Structure of the World. Princeton University Press, 1984. 321 p.

2.41. Shapere D. The Concept of Observation in Science and Philosophy // Philosophy of Science, 1982. Vol. 49, No. 4. P. 485-525.

2.42. Vallverdú J. Thinking Machines and the Philosophy of Computer Science: Concepts and Principles. Idea Group Inc (IGI), 2010. 435 p.

2.43. Whitley R. The Intellectual and Social Organization of the Sciences. Oxford: Oxford University Press, 1984. 319 p.

4.1.3 Course materials

The main book that will guide a student through the course is ***data History and Philosophy of Science: A guide for graduate students and applicants*** book. It contains all of topics of this course according to the schedule. It will provide you with useful links at the end of each chapter that will help students to improve their understanding of the topics.

4.1.4 Required feedbacks

Students are free to contact the lecturer by email. The name of department and a number of a group should be written in the subject or in the beginning of the letter for convenience. More information on how to contact the lecturer can be found in «Lecturer information» section of this Guide.

4.2 Course Structure

Learning Activities	**Hours**
Lectures	30
Practice sessions / Seminars,	16
Self-study Assignments	26
Final Exam (including preparation)	36
Total study hours	108

4.3 Time schedule of the course and course outline

№	*Theme*	*Week*	*Learning Activities*	*Hours*	*Home Assignment and Reading*
1	Module 1. General problems of the philosophy of science	1-18	**Topic 1** ” The Subject of History and Philosophy of Science”.	4	1.1, 2.1, 2.5, 22.22.6, 2.7, 2.9, 2.11, 2.21, 2.23, 2.25, 2.26, 2,28, 2.29, 2.30, 2.32, 2.33, 2.34
			Topic 2 ”Science as a System of Knowledge, Practice and a Social Institution. Role of Science in Development of Culture and Civilization”	4	1.1, 2.5, 2.12, 2.18, 2.35, 2.36, 2.38
			Topic 3 ”Origination of Science the Main Stages of Its Historical Evolution”	2	1.1, 2.24, 2.12, 2.13, 2.27, 2.33
			Topic 4 ”Main Concepts of Modern Philosophy of Science”	2	1.1, 2.2, 2.3, 2.7, 2.10, 2.19, 2.20, 2.21, 2.26,2.33
			Topic 5 ”Main Concepts of Modern Philosophy of Science”	4	1.1, 2.7, 2.12, 2.21, 2.25, 2.30, 2.36

			Topic 6 ”Structure of scientific knowledge”	4	1.1, 2.7, 2.12, 2.25, 2.26, 2.36, 2.39
			Topic 7 ”Science dynamics as a process of creating new knowledge. Communication in science”	2	1.1, 2.5, 2.33, 2.40
			Topic 8 ”Traditions and innovations in the development of science. Scientific revolutions. Types of scientific rationality”	4	1.1, 2.9, 2.12, 2.25, 2.33, 2.38
			Topic 9 ”Distinctive Features of Modern Science”	4	1.1, 2.8, 2.9, 2.26, 2.33
			Home assignment 1	6	
2	Module 2. Modern philosophical problems of the branches of scientific knowledge	1-18	Topic 1 ”Philosophical Problems of Informatics”	16	1.1, 2.15, 2.41
			Home assignment 2	20	

5	Final exam	36	Prepare to final exam. Preparation for answering exam questions (available at e-courses and course book) and the essay on the history of the relevant branch of science.

4.4 Module I. General Problems of Philosophy of Science

Topic 1. The Subject of History and Philosophy of Science

A philosophical study of science, its aims and goals. The problem of subject demarcation of philosophy of science, methodology of science, logic of science and science studies. Philosophy of science in the system of scientific knowledge.

Three aspects of science: science as a system of knowledge, science as human activity and science as a social institution. Variety of philosophical approaches to science. The role of basic philosophic notions in the formation of science image. Origination and the major stages of development of philosophy of science as an independent academic discipline. Logical and epistemological approach. Positivist tradition in philosophy of science. Philosophy of science and history of science. Wider range of philosophical subjects in post positivist philosophy of science. K.Popper, M. Polanyi, T.Kuhn, I. Lakatos and P. Feyerabend conceptions. Sociological and cultural approaches to the development of science. Internalism and externalism problems as they affect understanding of scientific work. M. Weber, A. Koyré, R. Merton and M. Mulkay conceptions.

Topic 2. Science as a System of Knowledge, Practice and a Social Institution. Role of Science in Development of Culture and Civilization

Knowledge as a product of scientific work. Different approaches to understanding of scientific knowledge. Theoretical form as a specific type of scientific knowledge representation in culture. Validity of scientific knowledge and

its systematization. Science as a deductive system of knowledge. Intersubjectivity of scientific knowledge. Universal value and truth of scientific knowledge. Practical applicability of scientific knowledge. Continuous nature of scientific knowledge. Modern approaches to studying scientific knowledge development. Science as a field of spiritual and practical activity and a social division of labor sphere. Obtaining and applying knowledge of laws of reality – aim of scientific work. Description, explanation and prediction of reality phenomena – goals of science. Scientific method as a culture of cognitive activity. Means of scientific research. Scientific research in how it depends on technology and industry level. Science as universal labor: scientist, discovery, society.

Different approaches to science as a social institution: Marxist definition of science as a social institution, Merton's sociology of science, social phenomenologists' view on science. Historical development of institutional forms of scientific work. Scientific communities and their historical types (invisible colleges; scientist republic; scientific communities of a disciplinary organized science era; interdisciplinary scientific communities of the XX century). Scientific schools. Scientific researcher education. Historical development of scientific knowledge translation ways. Computerization of science and its social consequences. Science and economy. Science and politics. Problem of secrecy in scientific research. Problem of state regulation in science.

Traditionalist and technogenic types of civilization development and their core values. Value of scientific rationality. Science and religion. Science and philosophy. Science and art. Role pf science in modern education and formation of personality. Social functions of science: cognitive, socio-cultural, ideological. Science as a direct creative force of society.

Topic 3. Origination of Science the Main Stages of Its Historical Evolution.

Problem of science origin as a problem of understanding of its essential features as well as of its genesis conditions and history periodization. Theories of science origin.

Protoscience and science. Two strategies of generating knowledge: generalization of practical experience and construction of theoretical models allowing to go beyond existing forms of production and common experience. Culture of antique city-states and origination of the first forms of theoretical science. Antique logic and mathematics. Development of logical norms of scientific thinking and science organization in medieval universities. Role of Christian theology in changing the contemplative stance of scientists: a person is a creator (from the small letter); manipulating natural objects – alchemy, astrology, magic. Western and eastern medieval science.

Development of experimental science in new European culture. Ideals of mathematized and experimental knowledge: Oxford school, Roger Bacon, William of Ockham. Preconditions of experimental method origination and its combining with mathematical description of nature. Galileo Galilei, Francis Bacon, René Descartes. Science influence on European world outlook.

Formation of science as a professionalized activity. Origination of disciplinary-organized science. Science application technologies. Formation of technical sciences. Development of social and humanitarian studies. Ideological grounds of a socio-historical study.

Revolutionary changes in the science of early XIX – late XX centuries. Non-classical science. Changing of the role of science in the structure of social production in the second half of the XX century. Development of nuclear power. Discovery of fusion power. Industrialization of scientific research. Value shift and the problem of humanization of science. Post-non-classical science.

Fundamental and applied sciences. Sciences studying a human being, society and technology. Natural sciences, social sciences and humanitarian studies. Interconnection of sciences and their change in the course of development. Leading sciences. Leader change in the history of science. Structure of modern science.

Topic 4. Main Concepts of Modern Philosophy of Science

Positivism as the first explicit conception of philosophy of science. Positivism genesis as a change in perception of the object of cognition, criteria of scientific knowledge, role and mechanisms of science development.

The First Positivism (Auguste Comte, Herbert Spencer, John Stuart Mill). Antimetaphysical stance as a basis of positivism. Notion of the positive knowledge. A. Comte's conception of three stages. Theological, metaphysical and positive (scientific) stages as characteristics of human thinking and society development. A. Comte's hierarchy of sciences. The idea of positive philosophy and positive social knowledge (sociology). The main principle of scientific cognition – subordination of imagination to observation. The idea of methodological unity of natural and social sciences on the basis of a natural sciences scientific standard.

John Stuart Mill: development of positive sciences method. Philosophy of experience as a critique of dogmatic empiricism. Continuity principle, inductive logic as a basis of a holistic experience. The idea of demarcation of physical phenomena and psychological experience. H. Spencer's evolutionism and organicism. The idea of science and religion demarcation.

The Second Positivism (empirical criticism) and the study of the mechanisms of cognition. E. Mach, R. Avenarius on "gnosiological roots of metaphisics". Avoiding "jumps" and "gaps" in scientific cognition as the main goal of empirical criticism. Ontology of empirical criticism: objective reality as a system of "perceptive complexes".

Neopositivism: logical and linguistic understanding of the object of scientific cognition. Relation between logical and grammatical links in utterances on objective reality (G. Frege, B. Russell, L. Wittgenstein). Logical and grammatical correctness as a criteria of utterance veracity. Principle of verification (empirical veracity). Linguistic turn in philosophy (L. Wittgenstein) as a transformation of the theory of cognition into the theory of language. Language game analysis. Semantics, syntax and pragmatics in language analysis. Vienna Circle (M. Schlick, R. Carnap): antimetaphysical approach, analysis of the language of science. Linguistic

analysis in analytical philosophy tradition as analysis of ordinary language meaning (G. Ryle, J. Wisdom, J. Austin, P. Strawson).

Postpositivism (T. Kuhn, I. Lakatos, P. Feyerabend) and critical rationalism (K. Popper) on mechanisms of scientific knowledge formation. Structural units of science: theory (K.Popper), paradigm (T.Kuhn), scientific research program (I. Lakatos). Popper's conception of three worlds: world of physical phenomena, world of psychological states, world of objective content of consciousness. Falsification (empirical possibility to prove a theory wrong) as demarcation criteria for scientific knowledge demarcation. Science dynamics: "normal science" periods and "scientific revolutions" (T.Kuhn), positive and negative heuristics in development of scientific research programs (I. Lakatos). Feyerabends methodological anarchism as a critique of cumulative model of science development. Methodological principle of proliferation of scientific theories as a basis of theoretical pluralism in science. "Anything goes" as the only universal methodological principle of scientific knowledge.

Objective and methodological dichotomy of scientific cognition: hermeneutics and neo-Kantianism (Baden school), reviewing the problem of social sciences and the humanities specific nature. Natural sciences and cultural sciences, human sciences (W. Dilthey, W. Windelband, H. Rickert): the nature of the object, the nature of determinism. The relation between the general and the particular: the humanities - individualizing (idiographic), natural - summarizing, generalizing (nomothetic). The principle of values reference as the basis of the methodology of social cognition. "Freedom from esteemation" as a methodological principle of interpretive sociology of Max Weber.

Phenomenological philosophy of science. E. Husserl on crisis of European science in its connection with positivist reduction. Science "Lebenswelt" roots as in pre-scientific, pre-reflexive world of human experience. Intentionality of consciousness. Natural disposition, "epohe", phenomenological reduction. A.

Schutz's phenomenological sociology of science. Everyday experience as a source of scientific notions and forms of logical thinking.

Postmodernism and philosophy of science: M. Foucault's "archeology of knowledge", J.-F. Lyotard's constructive postmodernism, J. Derrida's deconstructivism. Scientific discourse and political authorities. Discourse formation (M. Foucault).

Topic 5. Grounds of Science. Social and Cultural Factors Determining Them

Interaction of science with non-scientific types of knowledge. Knowledge and faith as fundamental types of human experience. Styles of thinking and transdisciplinary links in development of science.

Conceptual and philosophical grounds of science: role of philosophical ideas in the development of scientific grounds. Philosophical methodology as heuristic of scientific search. Conceptual and rational grounds of scientific cognition: truth in scientific cognition, truth and fallacy. Major criteria of veracity in science. Rationality types and the problem of scientific knowledge demarcation.

Scientific picture of the world as one of the most important conceptual grounds of scientific cognition. Main elements of the scientific picture of the world: time and space conditions and fundamental laws of nature. Ideals, primciples and norms of a scientific research: 1) conclusiveness, explanation and proof of scientific knowledge; 2) knowledge description and structuring.

Logical and methodological grounds of scientific knowledge. Three methodological levels in scientific work: philosophical, uniform for all sciences and specific for one particular science. Methods and theoretical problems. Disciplinary matrices of particular sciences (symbolic generalizations, values and particular problem example-solutions).

Role of methodological reflection and methodological synthesis in scientific cognition.

Topic 6. Structure of scientific knowledge.

The subject and the notion of scientific knowledge. Scientific knowledge organization forms: idea, problem, hypothesis, theory. Scientific knowledge as a dynamic cognitive system.

Relative nature of empirical and theoretical levels of scientific cognition. The role of theoretical notions. The idea of theoretical terms and counterarguments to it. The thesis of fundamental impossibility of reduction of theoretical terms to empirical ones.

Forms of scientific knowledge development: fact, problem, hypothesis, theory, scientific research program. Special features of a scientific fact. Requirements to an adequately formulated scientific problem. Hypothesis types. Logical and methodological requirements to a scientific hypothesis.

Scientific theory functions. Classification of scientific theories. Structure of a scientific theory. Formation and development of a scientific theory. Theoretical scheme as a coherent system of abstract objects of a given theory.

Scientific research program as a sequence of changing theories. Integrating model of scientific theories development. Stages of scientific systems testing: metatheoretical, intertheoretical, philosophical and empirical.

Topic 7. Science dynamics as a process of creating new knowledge. Communication in science.

The problem of new knowledge in science. Historical variability of social and cultural conditions and internal scientific mechanism of knowledge generation. Proving unity and necessity of knowledge: insufficiency of inductive or hypothetic and deductive methods.

Role and place of the grouns of science and its structural components in generating new knowledge. Double-oriented character of science grounds and its empirical data interaction. Primary theoretical models and laws formation. Role of analogy in theoretical search. Grounding and explaining procedures of theoretical knowledge, unacceptability of ungrounded claims. Interrelation between the logic

of discovery and the logic of grounding. Difference in science grounding between philosophy and natural sciences.

Formation of a well-developed scientific theory. Classical and non-classical types of theory formation. Mathematization of a scientific theory. The genesis of problem-solving examples in science (paradigm shift).

Problem situations in science. How particular scientific problems grow into wider scientific problems (problem approach). Science grounds development in cause by the influence of new theories. The problem of integrating new theoretical ideas into general culture. Science dynamics as a creative process of a scientific search.

The notion of scientific communication. Communicative ability of science as a consequence of its social and cultural nature. Communicative processes during science institutionalization: philosophical schools of antiquity as the core of communication, medieval university (patronage system), first organized scientific communities of early modern history and forms of interaction between scientists. Letters as a means of communication. “Invisible College”. Communication in the time of disciplinary-organized science formation. The first scientific journals. Communicative society phenomenon (J. Habermas). The Internet. Communication and the authorities (M. Foucault). Science in the system of authority relations. Scientific communication and discourse (M. Foucault, R. Barthes, J. Habermas).

Elements of communicative process in science. Types and forms of communication in science. Ambivalent nature of interaction among scientists. Problems of modern scientific communication. Communicative ability of scinece : cognitive and sociological, informational, hermeneutical and semantical approaches. Scientific communication as information; translation; dialogue and interaction.

Communication functions in science. Communication as a condition of creating and translation knowledge; a condition of mutual understanding and connection; an indicator of a scientific research line development ; a means of

scienist's socialisation. The link between the communicativeness of cognitive activity and knowledge verity.

Topic 8. Traditions and innovations in the development of science. Scientific revolutions. Types of scientific rationality.

The development of science as a system of synchronic (cooperation, competition) and diachronic (translation) processes of interaction. Scientific tradition as translation of scientific theories, methods, symbolic generalizations, science language and values. Structural units of a scientific tradition: paradigm (T.Kuhn), scientific research program core (I.Lakatos). Normal science as a traditional stage of scientific development within one paradigm.

M. Polanyi's implicit knowledge conception: tradition as translation of values, unspoken pre-conditions of scientific knowledge, models of problem setting and problem solving, scientific ethos. Scientific tradition as a means of making scientific activity stereotyped (P. Feyerabend).

Channels of scientific tradition translation: scientific schools, scientific lines. Non-institutionalized forms of scientific interaction: Invisible College conception. Scientific knowledge development factors. Main theoretic approaches to studying scientific knowledge dynamics: externalism, internalism, case-study method. Cumulativist and anti-cumulativist models of scientific knowledge growth, evolutionary and revolutionary processes in the development of science. Main types of scientific innovations: new theories, methods and objects of a scientific research.

Scientific revolutions as radical changes of scientific knowledge grounds and a scientific picture of the world. Positive and negative heuristics in scientific research program development (I.Lakatos), a scientific program "degeneration symptom" and its replacement by a new one. P. Feyerabend's epistemological anarchism as a proclamation of pluralism of scientific knowledge. The notion of proliferation as multiplication of mutually contradictive theories and hypotheses.

Scientific revolutions as an indicator of scientific rationality types genesis (classical, non-classical, post-non-classical). Main characteristics of a classical type of scientific rationality. The first scientific revolution of the XVII century: classical natural sciences and a mechanistic picture of the world. The second scientific revolution: disciplinary-organized science. Post-non-classical rationality: non-linear determinism, intersubjective nature of scientific cognition, social and cultural influence on science. The third scientific revolution – the late XIX – the first half of XX centuries: quantum-relativistic tendencies in natural sciences. The fourth scientific revolution – the second half of XX – the early XXI centuries: IT, systemic nature of scientific research.

Topic 9. Distinctive Features of Modern Science.

Science turning into an immediate productive force. Industrialization and intensification of scientific researches: big scientific centers, mathematization of knowledge, mathematic modeling and computer experiment. Industrially organized science and a scientist's self-fulfillment in a modern world.

New sciences origination: new research objects discovery; natural sciences, humanities and social studies integration; meta-scientific areas of research and theories. Object, method and ideals of modern science. Role of non-linear dynamics and synergetics in modern understanding of historically developing systems. Global evolutionism and the modern scientific picture of the world.

Convergence of natural sciences and humanitarian and social studies ideals. Comprehension of social and inner scientific values as a necessary condition of modern science development. Including social values in the process of scientific research strategy choice.

New ethical problems of science in the end of the XX century. The problem of humanitarian control in science and high technologies. Ecological, social and humanitarian expertise in scientific and technical projects.

Post-non-classical science and a shift in world outlook of the technogenic civilization. Scientism and anti-scientism. A search for a new way of civilization

development, new functions of science in culture. Role of science in solving global problems.

4. 5 Module 2. Philosophical Problems of Particular Sciences

Topic 1 Philosophical Problems of Informatics

Evolution of the subject of informatics in the second half of the XX century. C. Shannon's theory of information. N. Winner's, R. Ashby's, J. von Neumann's cybernetics. L. von Bertalanffy's general systems theory. Synergetic approach in informatics. H. Haken and D. Chernavskij. Informatics in the context of post-non-classical science and understanding of developing people-proportioned systems (V.S. Stepin).

The object and the subject of modern informatics. Initial (pre-scientific) understanding of information. Information – a universal category of all sciences. Statistical information theory and cybernetics. Negaentropy principle of information. Nature of social information in the unity of its semantic, syntactic and pragmatic characteristics. Attributive and functional-cybernatic conceptions of information. Informatics and synergetics.

Informational society and the problem of informational reality. The Internet as a semiotic system. The Internet as a special "virtual reality". Philosophical understanding of "virtual reality". The role of Internet and informational technologies in forming the modern society. Cyberspace notion.

5. Assessment

The first module (36 hours) ends with a test based on the results of testing. The second module (72 hours) ends with the preparation of an essay and passing the exam. The final exam is an oral exam.

Based on an independent study of historical and scientific material, a graduate student must submit an essay on the history of the relevant branch of science in agreement with the supervisor of the dissertation and the instructor of

the philosophy department. If there is a positive assessment, the graduate student is allowed to take an exam in the history and philosophy of science.

6. Attendance Policy

Students are expected to attend classes regularly. In case of missing an in-lab activity a student should perform additional work submitted to the instructor within a week after a class was missed.

Every topic involves an assignment. A written report on the assignment should be submitted within two weeks from the moment students received a list of problems. The final mark will rely on the same grading policy as for the final exam.

7. Required Course Participation

There are no special requirements for the course participation. The preferred type of report submission is the electronic one. Students can use the web-version of the course (link) for a better progress. All problems for solution could be found there together with text from the course book.

8. Facilities, Equipment and Software

There is no special equipment that is required for the course

Annex 1 Final Oral Exam Questions

Part 1. General Problems of Philosophy of Science.

1. Place and role of science in culture development.
2. Science and other types of cultural and cognitive activity (muth, art, religion, common mind cognition).
3. Philosophy and science. Role of philosophical ideas and principles in grounding scientific cognition.
4. Peculiarities of scientific cognition and scientific knowledge. Science as a systemic unity.
5. The problem of systematization and classification of sciences. Peculiarities of natural sciences and social and humanitarian sciences.
6. Formation and main stages of historical development of science.
7. Origination and development of ideals of mathematized and experimental scientific knowledge (G. Galilei, F. Bacon, R. Descartes).
8. Positivist tradition in philosophy of science (A. Comte, G. Spenser, E. Mach).
9. Neopositivism in philosophy of science: “Linguistic turn”.
10. Postpositivist problem field in philosophy of science. K. Popper’s critical rationalism.
11. Postpositivist conceptions in philosophy of science: I. Lakatos, P. Feyerabend.
12. Philosophical grounds of science. Ideals, principles and norms in a scientific study.
13. Scientific picture of the world, its historical forms and functions in the systemic organization of cognition and scientific world outlook.
14. Paradigms and theoretical models in scientific cognition.
15. Styles of thinking, interdisciplinary bonds and interactions in science.
16. Truth in scientific cognition. Truth and fallacy. Main criteria of knowledge verity in science.
17. Empirical and theoretical levels of scientific cognition.
18. Fact, notion and regularity in a scientific study.
19. Methodological reflection in science. Method classification.

20. General scientific methods and methods of particular sciences in scientific cognition.

21. The role of general scientific methods in solving theoretical problems.

22. Mathematization and modeling in a theoretical study.

23. A scientific theory as the most complete form of scientific cognition. Ways of a scientific theory formation.

24. Scientific traditions and scientific revolutions. T. Kuhn on the structure of scientific revolutions.

25. Social and cultural pre-conditions of scientific revolutions. Change in meaning of cultural world outlook grounds. Change in the grounds of science.

26. Historical change of scientific rationality types: classical, non-classical and post-non-classical science.

27. Main characteristics of modern post-non-classical science. Differentiation and integration processes in science.

28. Science dynamics as a process of generating new knowledge. Procedures of theoretical knowledge grounding.

29. Problem situations in science. Development of science grounds under the influence of new theories.

30. Synergetic approach in system analyses of science development.

31. Global evolutionism as a synthesis of evolutionary and systemic approaches in scientific cognition.

32. Link between social and intrinsic scientific values as a condition of timely development of science.

33. Scientism and anti-scientism. Post-non-classical science and values of technogenic civilization.

34. New ethical problems of science in the XXI century. Ecological ethic and its philosophical grounds.

35. Social values and the process of research strategy choice.

36. Science as a social institution. Sociological and cultural approaches to studying its functions.

37. Scientific communities and their historical types. Scientific schools and scientist training.

38. The problem of communication in science. Developing ways of scientific knowledge translation.

39. Internet, computerization and scientific knowledge development processes.

40. Interaction of science with non-scientific types of knowledge. Knowledge and faith.

Part 2. Modern Philosophical Problems of Particular Sciences (according to the post-graduate student's field of scientific study).

Philosophical Problems of Informatics:

1. Evolution of the subject of informatics understanding in the second half of the 20th century.

2. The object and the subject of modern informatics.

3. Statistical information theory and cybernetics. Negenthropic principle of information.

4. The meaning of social information in its semantic, syntactic and pragmatic characteristics unity.

5. Attributive and functional-cybernetic conceptions of information.

6. Synergetic approach to information.

7. Informational society and the problem of informational reality.

8. The Internet as a semiotic system. The Internet as a special "virtual" reality. Philosophical understanding of "virtual reality"

9. The role of the Internet and informational technologies in the development of modern society.

10. The notion of "cyberspace".

11. The problem of personality in informational society.

12. Cybernetics and information.

13. Synergetics and information.

14. Informatics as an interdisciplinary science.

15. Informatics and negenthropy.

Annex 2 Example of Final Oral Exam Questions

1. Place and role of science in culture development.

2. The Internet as a semiotic system. The Internet as a special “virtual” reality. Philosophical understanding of “virtual reality

3. The essay on the history of the relevant branch of science.