INSTITUTE OF PHILOSOPHY AND SOCIOLOGY

BULGARIAN ACADEMY OF SCIENCES

APPROVED BY:
Director of IPS
Prof. DSc. Emilia Chengelova

DOCTORAL PROGRAM "PHILOSOPHY OF SCIENCE

CURRICULUM

Educational and Qualification Degree: Doctor

Training Unit: Department "Philosophy of Science"

Professional Field: 2.3. Philosophy

Specialty: Philosophy of Science

Duration of Study: 3 years

Form of Study: Full-time, Independent Preparation

Program Annotation

The program offers an educational and scientific degree of "Doctor" in the field of Higher Education Area 2 "Humanities," professional field 2.3 "Philosophy" (Philosophy of Science). As a result of the most recent evaluation conducted on July 17, 2019 (Protocol No. 12), based on Article 88a, paragraph 5, item 1 of the Higher Education Act and Article 38, paragraph 2 of the Accreditation and Post-Accreditation Monitoring and Evaluation Regulations, the Standing Committee on Humanities and Arts granted program accreditation to the doctoral program "Philosophy of Science" from professional field 2.3 Philosophy, Higher Education Area 2. Humanities at the Institute for the Study of Societies and Knowledge at the Bulgarian Academy of Sciences (ISSK-BAS) with an overall score of 9.02. The training unit for the accreditation period is the section "Philosophy of Science."

Program Profile

Philosophy of Science is an interdisciplinary field that explores the philosophical foundations, methods, and implications of scientific knowledge. It examines the nature and structure of scientific theories, the methods and practices of scientific investigation, and the role of science in society. Philosophy of Science analyzes how scientific concepts develop and transform, how scientific facts are established, and the relationship between scientific theory and experiment. Additionally, it addresses epistemological questions related to the objectivity and validity of scientific knowledge, as well as the ethical and social aspects of scientific activity.

The field covers topics such as the structure of scientific revolutions, the nature of scientific explanations, the essence of the scientific method, the relationship between observation and theory, and issues related to realism and anti-realism in science. Philosophy of Science is critically important for understanding how science fits into the broader context of human knowledge and culture, and how it influences and is influenced by social and political factors. This area of philosophy is one of the most advanced contemporary fields within Philosophy, offering tools for analyzing and evaluating scientific practice and supporting the development of better methodological approaches and theoretical frameworks in various scientific disciplines. Currently, specialized areas such as Philosophy of Medicine, Philosophy of Space and Time, and Philosophy of Artificial Intelligence are particularly strongly represented, in addition to general training in General Philosophy of Science.

Program Mission

The mission of the Philosophy of Science program is to provide an in-depth understanding and professional-level acquaintance with the leading traditions and approaches in classical and contemporary philosophy of science. Simultaneously, it aims to develop critical skills essential for doctoral students, including the formulation, defense, and critical analysis of original philosophical-scientific theses. The program emphasizes the development and practice of critical thinking, preparing doctoral students for successful careers both within and beyond academia.

The program also strives to develop the following field-specific skills in doctoral students:

Analysis and Interpretation of Scientific Texts and Theories: Doctoral students will develop the ability to analyze and interpret foundational and contemporary texts and theories in the philosophy of science, including works by Karl Popper, Thomas Kuhn, Imre Lakatos, Rudolf Carnap, Michael Friedman, and Ian Hacking.

Description and Analysis of Scientific Practices: They will learn to describe and analyze scientific practices, identifying their structural and methodological characteristics.

Development and Argumentation of Philosophical Positions: Doctoral students will be trained to develop and argue philosophical positions in areas such as scientific knowledge, scientific theories, scientific experiments, and scientific explanations.

Analysis and Evaluation of Scientific Argumentation: Students will develop skills to analyze and evaluate the arguments behind scientific research and results, including the dynamics of scientific theories, models, and hypotheses, as well as skills to identify and address manipulative and misleading practices in science.

Contextualization and Transformation of Scientific Concepts: The program will prepare doctoral students to contextualize scientific concepts within various historical and cultural frameworks and to transform the ordinary meanings of scientific terms and notions.

Through these objectives, the program prepares doctoral students to contribute to the ongoing dialogue in the field of philosophy of science and to apply their knowledge and skills in various professional contexts. Graduates will be equipped to work as researchers, educators, and consultants, capable of analyzing and critically evaluating scientific processes and results, and developing innovative approaches in various scientific and technological fields.

Professional Competencies Acquired After Successful Defense of a Doctoral Dissertation

The doctoral program in "Philosophy of Science" aims to develop and deepen the theoretical knowledge and skills of doctoral students, fostering their ability to create research networks and enhancing their competencies in line with the latest scientific trends, with a special focus on interdisciplinarity.

Doctoral candidates admitted to the program will develop abilities for critical analysis of scientific concepts and theories, skills for developing philosophical arguments and positions, and competencies for analyzing scientific methodologies and practices. The program will prepare doctoral students to actively participate in scientific life, present and defend their research at international conferences and seminars, and publish the results of their research in prestigious scientific journals and publishers.

Graduates of the program will be well-prepared for successful careers in academia, research institutes, universities, and high schools (including groups 231 – University Teachers; 233 – Secondary Education Teachers (V-XII grade); 263 – Specialists in Social Sciences and Religious Specialists according to the National Classification of Occupations and Positions), government agencies, and non-governmental organizations. They will be able to apply their

knowledge and skills in developing scientific policies, ethical standards in science, and in the critical analysis of scientific practices and results. They will also be able to contribute to research projects related to the development and application of science in contemporary society.

PROGRAM STRUCTURE

Professional Qualification: Philosopher

Qualification Level: PhD (Doctor of Philosophy)

Specific Admission Requirements: Admission is based on the results of a doctoral examination in the specialty and a foreign language examination.

Recognition of Prior Learning: Standard administrative procedures apply.

Qualification Requirements and Rules: The preparation of doctoral students at the Bulgarian Academy of Sciences (BAS) within the Doctoral School and the implementation of their educational and research programs is based on a credit system. A doctoral candidate is admitted to pre-defense if they have accumulated a minimum of 200 credits.

Assessment Rules: Determined according to the curriculum of the respective disciplines. The doctoral minimum in the specialty includes a written and oral examination based on a syllabus prepared in accordance with the topic of the doctoral dissertation.

Completion Requirements: Development and defense of a doctoral dissertation.

Opportunities for Further Education: Postdoctoral programs at Bulgarian and international universities.

Number of Credits: 200 credits

Credits are accumulated from the following activities of the doctoral student:

Completion of the Educational Program (Minimum requirement of 130 points): 1.1. Successfully passed examination in the basic specialized subject – 40 points 1.2. For additional courses to achieve a general basic preparation in the respective scientific field or in an interdisciplinary field related to the dissertation topic – 20 points each, with a minimum of 2 courses x 20 points = 40 points 1.3. Successfully passed examination in language preparation – 25 points 1.4. Successfully passed examination in computer skills – 25 points

Number of Examinations: 5 examinations

Table 1: Educational Program

№	Name	Form of Assessment	Credits	Classroom Activities	Extracurricular Activities	Total Activities
1	Basic Specialized Subject	Exam	40	0	180	180
2	Additional Course 1	Exam	20	30	130	160
3	Additional Course 2	Exam	20	30	130	160
4	Language Preparation	Exam	25	120	Не е означена	120
5	Computer Skills	Exam	25	30	It is not indicated	30
Total Credits			**130**	Total Load		650

2. Approval of the Implementation of the Scientific Program (Minimum Requirement of 40 Points)

Presentation of scientific results related to the dissertation topic at scientific forums: 2.1. Presentation at a scientific seminar of the academic unit – 8 points 2.2. Presentation at a scientific event in the country – 24 points 2.3. Presentation at an international scientific event abroad or at an international scientific event in the country – 32 points

3. Publications of Scientific Results Related to the Dissertation Topic (Minimum Requirement of 30 Points)

The points related to publications of scientific results on the dissertation topic must comply with the minimum requirements for scientific fields from the "Regulations on the Conditions and Procedures for Acquiring Scientific Degrees and for Occupying Academic Positions at BAS," adopted by the General Assembly of BAS on 20.05.2019.

Table 2: Number of Points by Indicators (Field 2. Humanities)

Group of Indicators	Indicator	Number of points

Г	4. Published monograph that is not presented as the main habilitation work	100
	5. Published book based on a defended dissertation for the award of an educational and scientific degree "Doctor" or "Doctor of Science"	75
	6. Articles and reports published in scientific journals, refereed and indexed in world-renowned scientific databases	30/n
	7. Articles and reports published in non-refereed journals with scientific reviewing or in edited collective volumes	10/n
	8. Studies published in scientific journals, refereed and indexed in world-renowned scientific databases	45/n
	9. Studies published in non-refereed journals with scientific reviewing or in edited collective volumes	15/n
	10. Published chapter from a collective monograph	20/n
	11. Compilation of dictionaries	40/n

Completion Requirements and Further Education Opportunities

Completion Requirements: Development and defense of a doctoral dissertation

Opportunities for Further Education: Postdoctoral programs at Bulgarian and international universities

CURRICULUM

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PROGRAM STRUCTURE

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Qualification Level: PhD (Doctor of Philosophy)

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Assessment Rules: Determined according to the curriculum of the respective disciplines. The doctoral minimum in the specialty includes a written and oral examination based on a syllabus prepared in accordance with the topic of the doctoral dissertation.

Completion Requirements: Development and defense of a doctoral dissertation.

Opportunities for Further Education: Postdoctoral programs at Bulgarian and international universities.

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	8. Studies published in scientific journals, refereed and indexed in world-renowned scientific databases	45/n
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	10. Published chapter from a collective monograph	20/n
	11. Compilation of dictionaries	40/n

Completion Requirements and Further Education Opportunities

Completion Requirements: Development and defense of a doctoral dissertation

Opportunities for Further Education: Postdoctoral programs at Bulgarian and international universities

Prepared by: Assoc. Prof. Dr. Boris D. Grozdanoff

COURSE CURRICULA

Doctoral Program "Philosophy of Science"

COURSE CURRICULUM

1. Course Title: **Rationality and Artificial Intelligence**
2. Course Type: **Elective** (for general basic preparation in the respective scientific field)
3. Course Level (Educational and Scientific Degree): **Doctoral**
4. Lecturer's Name: **Assoc. Prof. Dr. Boris Grozdanoff**

Course Workload	**Form**	**Horarium**
Classroom Workload	Lectures	30
	Seminar Exercises	0
Total Classroom Workload		**30**
Extracurricular Workload	Conceptual Project	60
	Literature Review	30
Extracurricular Workload		**90**
TOTAL WORKLOAD		**120**

№	**Grade Formation for the Course**	**% of assessment**
	Course work	50
	Exam	50

Course Annotation:

The objective of the course is to introduce doctoral students to the contemporary interdisciplinary debate on artificial intelligence (AI), focusing on theories of rationality, large language model (LLM) architectures, deep reinforcement learning (DRL) methods, and synthetic data. The course will explore the history and development of these key areas, present the main concepts and approaches used in the creation and training of LLMs and DRL systems, and discuss leading positions on the nature of rationality and intelligence. Special attention will be given to the challenges in implementing these approaches, including the creation and use of synthetic data for training. The course will also cover some hardware aspects of AI architectures and training, including specific computational requirements and optimizations for LLMs and DRL methods. The program will equip doctoral students with the necessary knowledge and skills to actively participate in contemporary research and developments in the field of artificial intelligence.

Preliminary Requirements:

Basic knowledge in analytical philosophy, artificial neural networks, and deep reinforcement learning (DRL).

Expected Results:

Upon completing the course, doctoral students will acquire in-depth knowledge of large language models (LLMs) and deep reinforcement learning (DRL), understanding the fundamental concepts and principles that guide them. They will be capable of comprehending and utilizing synthetic data for training AI models, evaluating the effectiveness and quality of these data. Students will gain insights into the historical development of artificial intelligence and engage in major philosophical and theoretical debates in the field, enabling them to analyze various approaches to rationality and intelligence. The course will prepare them to identify and overcome leading problems and challenges associated with implementing AI systems, and to develop solutions and innovations in the context of contemporary AI research and practices. They will be ready to actively participate in international conferences, seminars, and research projects, effectively presenting and defending their scientific results before the academic community and industry. The course will provide doctoral students not only with theoretical knowledge but also with critical thinking and analytical skills necessary for a successful career in artificial intelligence. They will be equipped to handle the challenges of the rapidly evolving technological environment and make significant contributions to the advancement of AI research and applications.

Course contents

№	Topic:	Hours
1	History and Evolution of Artificial Intelligence	2
2	Philosophical Foundations of Rationality	2
3	Theoretical Models of Rationality in AI	2
4	Symbolic Approaches to AI	2
5.	Computational Approaches to Rationality	2
6	Large Language Models (LLMs) and the Philosophy of Language	2
7	Deep Reinforcement Learning (DRL) and Rationality	2

8.	Synthetic Data and Ethics	2
9	Hybrid Approaches in AI	2
10	Cognitive Sciences and AI	2
11	Philosophy of Mind and AI	2
12	Rationality and Decision Making in AI	2
13	Hardware Aspects of AI	2
14	Experimental Philosophy and AI	2
15	The Future of Rationality and AI	2

Exam Syllabus and Core Bibliography

№	
1	Describe the main stages in the history and evolution of artificial intelligence.
2	What are the different philosophical concepts of rationality, and how are they applied in artificial intelligence?
3	Explain the theoretical models of rationality used in AI and compare their approaches.
4	What are the main principles of symbolic approaches to AI, and what are their advantages and disadvantages?
5	How do computational methods and algorithms support rational behavior in AI systems?
6	How do large language models (LLMs) interact with the philosophy of language and meaning?

7	Describe deep reinforcement learning (DRL) methods and how they model rational behavior.
8	What ethical issues are associated with the use of synthetic data in training AI models?
9	How are symbolic and computational methods combined in hybrid approaches to achieve more effective AI systems?
10	What are the connections between cognitive sciences and the development of artificial intelligence?
11	What philosophical questions arise in relation to consciousness and its possible simulation through AI?
12	What decision-making models are used in AI, and how can they be optimized for rationality?
13	What are the hardware requirements and architectures necessary for the effective training and execution of AI models?
14	How can experimental philosophy be used to test and validate philosophical theories through AI?
15	What are the future trends and opportunities in the development of rationality in AI, and what are the potential philosophical implications?

Bibliography:

McCarthy, John, et al. "A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence." 1955.

Turing, Alan M. "Computing Machinery and Intelligence." Mind, 1950.

Newell, Allen, and Herbert A. Simon. "GPS, a program that simulates human thought." In Computers and Thought, 1963.

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Prepared by: Assoc. Prof. Dr. Boris D. Grozdanoff

BULGARIAN ACADEMY OF SCIENCES

Institute of Philosophy and Sociology

Philosophy of Science Department

TEACHING COURSE

1. Name of the course: Theory of scientific knowledge
2. Type of course: compulsory / elective / optional
3. Course level: Ph.D
4. Name of the lecturer: Anguel S. Stefanov

Academic Workload	**Form**	**Horarium**
Classwork Workload	Lectures	30
	Seminars	
	Practical exercises	
Total auditorium Workload		**30**
Extracurricular Workload	Report	
	Paper/Presentation	
	Scientific essay	90
	Study project	
Total Extracurricular Workload		**90**
Total Workload		**120**
Credits auditorium workload		
Credits extracurricular workload		
TOTAL		

№	**Formation of the discipline assessment**	**% of assessment**
1.	Participation in thematic discussions in class	10

2.	Demonstration classes	
3.	Research work	
4.	Report	
5.	Paper/Presentation	
6.	Scientific essay	40
7.	Study project	
8.	End of course work	
9.	Exam	50

Abstract of the course:
The course aims to provide knowledge in the field of epistemology and philosophy of science that builds on the content of these disciplines taught in the undergraduate and graduate forms of study.

Preliminary requirements:

Expected results:
Providing a theoretical foundation for future research on the application of logical systems and models for the explication of scientific knowledge.

Educational content

№	Topic:	Horarium
1	What is knowledge? Analytical and metaphysical approach. Knowledge in the context of analytic philosophy, defined as "justified true belief" and the resulting "Gauthier problem" from this definition. Presentationist, representationist and transcendental approach to knowledge.	2 hrs
2	Cognitive boundaries. Transcendental illusions. Those about the thematic limitation of scientific knowledge in depth and extent. Environmental problems. Limits of applicability of scientific theories.	2 hrs
3	K. Gödel's incompleteness theorems. Notions of contradiction and completeness of a theoretical system. Formulation of K. Gödel's two incompleteness theorems. Philosophical interpretation of incompleteness theorems.	2 hrs
4	Is logic empirical? H. Putnam's analogy between the empirical nature of geometry and that of logic. Quantum logic as logic applicable to the description of the manifestations of quantum objects in experience. Discretion and formal systems applicable to specific situations.	2 hrs
5	Types of scientific explanation. What is a scientific explanation? Explanans and explanandum. Deductive-nomological model, probabilistic model, teleological explanations in science.	2 hrs

6	Logical structure of scientific theory. A syntactic and semantic approach. Hierarchical structure of theoretical knowledge. Hypothetico-deductive understanding of scientific theory. Semantic approach – presenting the theory as a family of models.	2 hrs
7	Hempel's "theoretician's dilemma". Instrumentalism. Formulation of the Hempel's theoretician's dilemma. Supraempirical content of theoretical constructs. Theory as a tool for predicting new observable facts.	2 hrs
8	Popper's Falsificationist Methodology. The Duhem-Quine Thesis. The evolutionary epistemology of K. Popper. The falsifiability of a scientific hypothesis is related to the accepted background knowledge. Formulation of the Duhem-Quine thesis. Conventionalism.	2 hrs
9	Science and Pseudoscience. Definition of pseudoscience. On the damage of pseudoscience. The demarcation criterion for scientific validity and its dependence from the philosophical framework in which it is placed.	2 hrs
10	The Correspondence Principle. The initial formulation by N. Bohr. Formulation of the principle of correspondence as an gnoseological regulative principle. Difficulties regarding the claims of this principle. Attempts at improved formulation.	2 hrs

11	T. Kuhn and P. Feyerabend's Thesis of Incommensurability. The epistemological essence of the incommensurability thesis between scientific theories and paradigms. An explicit presentation of the thesis as a set of sub-theses. An evaluation of the attempts at a critique of this thesis.	2 hrs
12	The Dynamics of Scientific Knowledge. T. Kuhn's Paradigmatic Approach. Methodological approaches towards understanding the dynamics of scientific knowledge. Concepts of normal science, scientific community, and paradigm. T. Kuhn's view on paradigm change and his critics.	2 hrs
13	The scientific research programs of I. Lakatos. The development of scientific knowledge as development and change of research programs. The core of research program. Positive and negative heuristics. Epistemological qualities that distinguish the better of two successive theories in one progressing research program.	2 hrs
14	The anthropic principle. Versions and interpretations. What is the main message of the anthropic principle. Weak, strong, and participatory versions of the anthropic principle. Characteristics of its teleological and naturalistic interpretations.	2 hrs
15	Socio-cultural determinants of scientific knowledge. Internalism and externalism regarding the driving factors for the development of scientific knowledge. The style of thinking as a mediator between science and culture.	2 hrs

Examination synopsis

№	Question
1	What is knowledge? An Analytical and metaphysical approach.
2	Cognitive boundaries.
3	Gödel's incompleteness theorems.
4	Is logic empirical?
5	Types of scientific explanation.
6	Logical structure of scientific theory. A Syntactic and semantic approach.
7	Hempel's "theoretician's dilemma". Instrumentalism.
8	Popper's falsificationist methodology. The Duhem-Quine thesis.
9	Science and pseudoscience.
10	Correspondence principle.
11	T. Kuhn and P. Feyerabend's thesis of incommensurability.
12	The Dynamics of Scientific Knowledge. T. Kuhn's Paradigmatic Approach.
13	The scientific research programs of I. Lakatos.
14	The anthropic principle. Versions and interpretations.
15	Socio-cultural determinants of scientific knowledge.

Basic Bibliography:

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