NJSC SHAKARIM UNIVERSITY OF SEMEY

EDUCATIONAL PROGRAM

8D05 - Natural Sciences, Mathematics and Statistics
(Code and classification of the field of education)

8D053 - Physical and chemical sciences
(Code and classification of the direction of training)

0530
(Code in the International Standard Classification of Education)

D090 Physics
(Code and classification of the educational program group)

8D05302 - Technical Physics
(Code and name of the educational program)

Doctor of philosophy (PhD)
(Level of preparation)

Semey

Educational program

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Doctor of philosophy (PhD)
(Level of preparation)

Semey 2023

PREFACE

Developed

The educational program 8D05302 - Technical Physics in the direction of preparation 8D053 - Physical and chemical sciences on the basis of the State Compulsory Standards of Higher and Postgraduate Education approved by the Order of the Ministry of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No 2 (as amended by the order) was developed by the Academic Committee dated 20.02.2023 No 66).

Members of the Academic Committee	Full name	Academic degree, academic title, position	Signature
Head of the Academic Committee	Nurymkhan Gulnur	Dean of the faculty of engineering and technology, PhD	
Educational program manager	Kassymov Askar	Acting associate professor of the department of technical physics and heat power engineering	
Member of the AC	Stepanova Olga	Head of the department of technical physics and heat power engineering, PhD	
Member of the AC	Yermolenko Mikhail	Senior lecturer of the department of technical physics and heat power engineering, c.t.s.	
Member of the AC	Vityuk Vladimir	PhD, Deputy Director General for Science of the National Nuclear Center of the Republic of Kazakhstan	
Member of the AC	Mukhamedov Nurzhan	Head of the Laboratory of the IAE branch of the RSE NNC RK	
Member of the AC	Baibassarova Anelya	PhD student of group DTF-101	
Member of the AC	Tulenbergenov Timur	PhD student of group DTF-201	

Reviewing

Full name of the reviewer	Position, place of work	Signature
Chektybayev Baurzhan	Head of the Thermonuclear Research Department of the IAE branch of the RSE NNC RK	

Reviewed

at the meeting of the Quality Assurance Commission of the Faculty of Engineering and Technology
Recommended for approval by the Academic Council of the University
Protocol № 4.6 "10" April 2023
Chairwoman of the Commission on Quality Assurance Abdilova G.

Approved at the meeting of the Academic Council of the University Protocol No. 8 "25" April 2023.

Approved

at the meeting of the Academic Council of the University
Protocol № 1 "01" of September 2023
Chairman of the Academic Council of the University Orynbekov D.R.

Content

1.Introduction

1.1.General data

Training under the educational program 8D05302 Technical Physics is carried out at the Department of Technical Physics and Heat Power Engineering of the Faculty of Engineering and Technology.

The educational program for the preparation of a Doctor of Philosophy (PhD) has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in- depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere. During the implementation of the educational program, the features of training specialists characteristic of the Shakarim University of the city of Semey and the region were taken into account.

The uniqueness of this educational program lies in the fact that the training of specialists in this field is carried out in close cooperation with the National Nuclear Center of the Republic of Kazakhstan and the Center for Nuclear Medicine and Oncology of the city of Semey.

1.2.Completion criteria

The main criterion for the completion of the educational process for the preparation of PhD doctors is the student`s mastering of at least 45 credits of theoretical education, as well as at least 123 credits of doctoral student`s research work, including internship and doctoral dissertation, at least 12 credits for writing and defending a doctoral dissertation.

1.3.Typical study duration: 3 years.

2.PASSPORT OF THE EDUCATIONAL PROGRAM

2.1.EP purpose	Training of highly qualified personnel in the field of technical physics with advanced professional, research and management competencies for a successful career in the academic community, public administration and industry.
2.2.Map of the training profile within the educational program	
Code and classification of the field of education	8D05 - Natural Sciences, Mathematics and Statistics
Code and classification of the direction of training	8D053 - Physical and chemical sciences
Code in the International Standard Classification of Education	0530
Code and classification of the educational program group	D090 - D090 Physics
Code and name of the educational program	8D05302 - Technical Physics
2.3.Qualification characteristics of the graduate	
Degree awarded / qualification	PhD in the educational program 8D05302 «Technical physics»
Name of the profession / list of positions of a specialist	Engineer-physicist, specialist of higher, I and II categories, junior researcher, researcher, lecturer of special disciplines of the course of technical physics in higher educational institutions.
OQF qualification level (industry qualification framework)	8
Area of professional activity	Industry, energy, education, science, medicine
Object of professional activity	Enterprises and firms of energy and technological profiles. Research institutions. Medical institutions. Higher and secondary specialized educational institutions. Akimats and ministries.
Types of professional activity	Research and innovation activities. Organizational and managerial activities. Educational (pedagogical) activity.
Graduate Model	Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes. Interpret the results of the study and the limits of their application. Interpret the physical essence of the phenomena and processes of heat transfer in scientific creativity and professional activities. Form a scientific approach in the creation of new generation nuclear reactors. Substantiate modern approaches to the issue of radiation safety within the framework of legislation and research activities. Form a scientific approach in matters of statistical physics and thermodynamics of irreversible processes. Structure the information on the problems of thermophysics of materials in research activities.

	Form a scientific approach in the field of radiation protection and control of nuclear materials. Develop modern approaches to the issues of physical research using information technologies.

3.Modules and content of the educational program

Research in scientific and pedagogical activities

Academic writing

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	29197 (3010300)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

The discipline covers all types of writing activities during PhD doctoral studies. Academically literate writing is an integral part of effective research activities. Important aspects of the competent writing of scientific articles, applications for grant funding, reports on research studies, and a future doctoral dissertation are considered. The choice of one or another genre of academic writing is substantiated, as well as the features of structuring, annotating, reviewing written works.

Purpose of studying of the discipline

The development of lexical, grammatical, stylistic and compositional-structural knowledge and the formation of skills in the author`s writing of academic texts in the framework of educational and research activities.

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.

Prerequisites

Masters degree course

Postrequisites

Final examination

Research methods

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	29849 (3010301)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

The course examines the basic concepts necessary for conducting research work as part of a dissertation work. The main ways of obtaining and systematizing scientific knowledge are touched upon. Particular attention in the course of studying this discipline is paid to the use of existing scientific achievements for the own scientific research. Along with this, the ways of using modern information technologies, as well as the issues of interdisciplinary relations in scientific research are considered.

Purpose of studying of the discipline

Improving the practical knowledge of research methods in organizing and conducting experiments, including the skills of interpreting the results obtained and presenting them in scientific works.

Learning Outcomes

ON2 Interpret the results of the study and the limits of their application.

Prerequisites

Masters degree course

Postrequisites

Final examination

Research work of the doctoral student, including internship and doctoral dissertation I

Discipline cycle	Profiling discipline
Discipline component	University component

SubjectID	29861 (3010311)
Course	1
Term	1
Credits count	15
Working practice	450hours
Total	450hours
Knowledge control form	Total mark on practice

Short description of discipline
Formulation of the topic of the doctoral dissertation and approval of the individual work plan of the doctoral student. At this stage, the relevance, scientific novelty, object and subject of research, as well as the scientific and practical significance of the dissertation work are determined.

Purpose of studying of the discipline
Formulation and approval of the topic of a doctoral dissertation

Learning Outcomes
ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites
Research methods

Postrequisites
Research work of the doctoral student, including internship and doctoral dissertation II

Research work of the doctoral student, including internship and doctoral dissertation II

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	29881 (3010312)
Course	1
Term	2
Credits count	20
Working practice	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline
Formulation of a hypothesis, which will subsequently have to be confirmed or refuted in the course of work on a doctoral dissertation. The hypothesis should be related to the topic of the dissertation.

Purpose of studying of the discipline
Formulation of the research hypothesis

Learning Outcomes
ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites
Research work of the doctoral student, including internship and doctoral dissertation I

Postrequisites
Research work of the doctoral student, including internship and doctoral dissertation III

Pedagogical practice

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	29882 (3010302)
Course	2
Term	1
Credits count	10
Pedagogical practics	300hours
Total	300hours
Knowledge control form	Total mark on practice

Short description of discipline
The pedagogical practice of the doctoral student is an important practical component of the third stage of higher education. The purpose of teaching practice is to study the specifics of educational and methodical work and the formation of practical skills and methods of teaching in higher education

Purpose of studying of the discipline

Learning Outcomes
ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.

Prerequisites
Masters degree course
Postrequisites
Final examination

The physical essence of phenomena and processes in technical physics

Thermodynamics, statistical physics

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	29850 (3010303)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline
The course is aimed at studying the thermodynamic properties of substances from the standpoint of statistical physics. With this approach, the properties of the systems under consideration are studied as a result of the interaction of structural elements that form it. In contrast to phenomenological approach, the average result of the processes taking place at the microscopic level plays a significant role in statistical consideration. Considerable attention is paid to the mathematical apparatus for processing an array of data obtained as a result of describing the properties of microsystems.
Purpose of studying of the discipline
The purpose of the course "Thermodynamics, Statistical Physics and Physical Kinetics" is to study the basic ideas and prerequisites underlying the description of random processes occurring in nature under real conditions and in real systems, which, as a rule, have an infinite number of degrees of freedom in the presence of an active external influence. environment. Preparation of PhD students for research, scientific and innovative, organizational, managerial and pedagogical activities in research institutes, higher and secondary educational institutions, laboratories, design or design bureaus, enterprises.
Learning Outcomes
ON3 Interpret the physical essence of the phenomena and processes of heat transfer in scientific creativity and professional activities.
Prerequisites
Masters degree course
Postrequisites
Final examination

Information and measuring systems and technologies in thermal physics

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29880 (3010309)
Course	1
Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline
This course considers the use of modern information technologies for research in the field of thermal physics. The main packages of applied programs, which make it possible to build and study thermophysical models of key processes that take place in technical physics are studied. An important role is given to methods of mathematical optimization and processing of the obtained data. Along with this, the issues of automation of measurements in the course of scientific research are considered.
Purpose of studying of the discipline
To form the core competencies in the field of using information technologies in thermal physics
Learning Outcomes
ON7 Structure the information on the problems of thermophysics of materials in research activities.
ON9 Develop modern approaches to the issues of physical research using information technologies.
Prerequisites
Masters degree course
Postrequisites
Final examination

Methods and procedures for accounting and control of nuclear material

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29877 (3010306)
Course	1
Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

This course covers all important aspects related to the use of nuclear materials used in reactors for various purposes. All legal and technical issues of control and accounting of nuclear materials are studied. All technological processes associated with the movement, storage and inventory of nuclear materials are substantiated. Particular attention is paid to the technical means of working with nuclear materials and all accompanying documentation in accordance with the law.

Purpose of studying of the discipline

Acquisition of knowledge that makes it possible to formulate and define the main provisions of the Law on the Use of Atomic Energy, which determine the essence of the requirements for accounting and control of nuclear materials at nuclear power plants, the main characteristics of the processes responsible for changing the amount of nuclear materials during the operation of nuclear fuel at nuclear power plants, the main characteristics of the components of the nuclear material balance zone at nuclear power plants , nuclear fuel flow patterns at NPPs, rules for maintaining material balance and operational accounting documents, methods, procedures and technical measuring instruments used for accounting and control of nuclear materials at NPPs, basic requirements for nuclear safety during physical start-up, reaching the minimum controlled level, and work in basic mode.

Learning Outcomes

ON4 Form a scientific approach in the creation of new generation nuclear reactors.
ON5 Substantiate modern approaches to the issue of radiation safety within the framework of legislation and research activities.
ON8 Form a scientific approach in the field of radiation protection and control of nuclear materials.

Prerequisites

Masters degree course

Postrequisites

Final examination

Theory of protection against ionizing radiation

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29878 (3010307)
Course	1
Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

The discipline considers the theoretical foundations of protection against various types of ionizing radiation. The main aspects of the impact of ionizing radiation on various materials are shown. Significant attention is paid to the effect of ionizing radiation on biological objects, especially on the human body. The substantiation of methods of protection against various types of radiation and the physical processes underlying them are considered in detail. Methods of dosimetric control at facilities operating nuclear materials are shown.

Purpose of studying of the discipline

The purpose of the discipline "Theory and protection against ionizing radiation" is to acquire competencies in radiation dosimetry, calculation of optimization and design of protection against ionizing radiation of nuclear installations.

Learning Outcomes

ON4 Form a scientific approach in the creation of new generation nuclear reactors.
ON5 Substantiate modern approaches to the issue of radiation safety within the framework of legislation and research activities.
ON8 Form a scientific approach in the field of radiation protection and control of nuclear materials.

Prerequisites

Masters degree course

Postrequisites

Final examination

Thermophysical properties of materials

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29879 (3010308)
Course	1
Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

This course considers methods for studying the thermophysical properties of materials in various states of aggregation. Methods for carrying out experimental and theoretical research in the field of thermal physics are shown. The principles underlying the determination of the thermophysical properties of substances and the main measuring instruments operating on the basis of these principles are studied. The relationship between the structure of substances and their thermophysical properties, as well as methods for predicting the properties of new materials, are considered.

Purpose of studying of the discipline

To form knowledge about the mechanical, thermophysical, electrical, magnetic, optical properties of materials, to teach methods for determining thermophysical characteristics.

Learning Outcomes

ON3 Interpret the physical essence of the phenomena and processes of heat transfer in scientific creativity and professional activities.
ON7 Structure the information on the problems of thermophysics of materials in research activities.

Prerequisites

Masters degree course

Postrequisites

Final examination

Thermodynamics of irreversible processes

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29875 (3010305)
Course	1
Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

This course studies the theoretical foundations of the processes that take place in the absence of thermodynamic equilibrium in the system under consideration. Under such physical conditions, various kinds of non-equilibrium processes occur, associated with the transfer of one or another physical quantity. The main factors and criteria for the stability of the state of a thermodynamic system are considered. At the same time, important attention in the course is paid to studying the behavior of the system under the influence of external forces.

Purpose of studying of the discipline

The purpose of this course is to study the main provisions and conclusions of the thermodynamics of irreversible processes, the formation of a creative approach to solving practical problems related to non-stationary, non-equilibrium flows of matter, energy and charge in physical systems.

Learning Outcomes

ON3 Interpret the physical essence of the phenomena and processes of heat transfer in scientific creativity and professional activities.
ON6 Form a scientific approach in matters of statistical physics and thermodynamics of irreversible processes.

Prerequisites

Masters degree course

Postrequisites

Final examination

Nuclear fuel cycle of a new generation

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	29274 (3010304)
Course	1

Term	2
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

This course is aimed at studying the problems associated with the implementation of the nuclear fuel cycle. The whole sequence of technological operations from fuel extraction to the final disposal of radioactive materials formed during the use of nuclear fuel is considered. From the point of view of the latest scientific developments, ways to improve the efficiency and safety of each stage of the nuclear fuel cycle are shown. The development prospects are considered taking into account the further development of the nuclear industry of the Republic of Kazakhstan.

Purpose of studying of the discipline

To form the core competencies in the development of a new generation NFC, taking into account energy-saving technologies

Learning Outcomes

ON3 Interpret the physical essence of the phenomena and processes of heat transfer in scientific creativity and professional activities.
ON4 Form a scientific approach in the creation of new generation nuclear reactors.
ON5 Substantiate modern approaches to the issue of radiation safety within the framework of legislation and research activities.
ON8 Form a scientific approach in the field of radiation protection and control of nuclear materials.

Prerequisites

Masters degree course

Postrequisites

Final examination

Research work of the doctoral student, including internship and doctoral dissertation III

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	33404 (3010313)
Course	2
Term	1
Credits count	20
Working practice	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline

Choice of research methods. At this stage, it is necessary to choose methods that correspond to the subject of the study. The right choice of methods will provide the researcher with the necessary material for a future doctoral dissertation.

Purpose of studying of the discipline

Determination of research methods.

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites

Research work of the doctoral student, including internship and doctoral dissertation II

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation IV

Research work of the doctoral student, including internship and doctoral dissertation IV

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	27985 (3010314)
Course	2
Term	2
Credits count	30
Working practice	900hours
Total	900hours
Knowledge control form	Total mark on practice

Short description of discipline

Conducting theoretical and experimental research. This stage actually represents the main part of the research, during which the doctoral student will work on the accumulation of empirical data. Correctly performed experiments determine the success of further research.

Purpose of studying of the discipline

Obtaining empirical data.

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation V

Research practice

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	29883 (3010310)
Course	3
Term	1
Credits count	10
Working practice	300hours
Total	300hours
Knowledge control form	Total mark on practice

Short description of discipline

The research practice of the doctoral student is conducted in order to familiarize with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data and their application in further activities.

Purpose of studying of the discipline

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.

Prerequisites

Academic writing Research methods

Postrequisites

Final examination

Research work of the doctoral student, including internship and doctoral dissertation V

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	33405 (3010315)
Course	3
Term	1
Credits count	20
Working practice	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline

Processing and interpretation of the obtained results. Correct processing of the data obtained as a result of experimental studies will allow to give a direct answer to the goal and objectives of the study.

Purpose of studying of the discipline

Analysis of data obtained as a result of research.

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites

Research work of the doctoral student, including internship and doctoral dissertation IV

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation VI

Research work of the doctoral student, including internship and doctoral dissertation VI

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	33407 (3010316)
Course	3
Term	2

Credits count	18
Working practice	540hours
Total	540hours
Knowledge control form	Total mark on practice

Short description of discipline
Formulation of research results in a single dissertation work. At this stage, the doctoral student needs to analyze all the material received during the entire period of study and assemble it into a coherent structured document.

Purpose of studying of the discipline
Formulation of a doctoral dissertation

Learning Outcomes
ON1 Use the possibilities of written communication in the academic and scientific and technical fields when writing research papers and conducting classes.
ON2 Interpret the results of the study and the limits of their application.
ON9 Develop modern approaches to the issues of physical research using information technologies.

Prerequisites
Research work of the doctoral student, including internship and doctoral dissertation V

Postrequisites
Final examination

Final attestation

Doctoral dissertation

Credits count	12

4.Summary table on the scope of the educational program

«8D05302 - Technical Physics»

Name of discipline	Cycle/ Component	Term	Number of credits	Total hours	Lec	SPL	LC	IWST	IWS	Knowledge control form
Research in scientific and pedagogical activities										
Academic writing	BS/US	1	5	150	30	15		35	70	Examination
Research methods	BS/US	1	5	150	30	15		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation I	AS/US	1	15	450						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation II	AS/US	2	20	600						Total mark on practice
Pedagogical practice	BS/US	3	10	300						Total mark on practice
The physical essence of phenomena and processes in technical physics										
Thermodynamics, statistical physics	BS/US	1	5	150	30	15		35	70	Examination
Information and measuring systems and technologies in thermal physics	AS/CCh	2	5	150	30	15		35	70	Examination
Methods and procedures for accounting and control of nuclear material	AS/CCh	2	5	150	30	15		35	70	Examination
Theory of protection against ionizing radiation	AS/CCh	2	5	150	30	15		35	70	Examination
Thermophysical properties of materials	AS/CCh	2	5	150	30	15		35	70	Examination
Thermodynamics of irreversible processes	AS/CCh	2	5	150	30	15		35	70	Examination
Nuclear fuel cycle of a new generation	AS/CCh	2	5	150	30	15		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation III	AS/US	3	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation IV	AS/US	4	30	900						Total mark on practice
Research practice	AS/US	5	10	300						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation V	AS/US	5	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation VI	AS/US	6	18	540						Total mark on practice
Final attestation										
Doctoral dissertation		10	12	360						