

**THE MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION  
FEDERAL STATE AUTONOMOUS EDUCATIONAL  
INSTITUTION OF HIGHER EDUCATION  
NATIONAL RESEARCH NUCLEAR UNIVERSITY "MEPHI"**

**APPROVED**

First Vice-rector NRNU MEPHI

\_\_\_\_\_ O. V. Nagornov

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\_\_\_\_\_ 2018 г.

**COMPETENCE MODEL OF THE  
MASTER DEGREE PROGRAM**

**direction of education**

**14.04.02 NUCLEAR PHYSICS AND TECHNOLOGY**

**Master program:**

**NUCLEAR ENGINEERING**

Moscow

2018

## **1. GENERAL PROVISIONS**

1.1. Competence model complies with the requirements of the OS in the NRNU MEPHI in 14. 04.02 – Nuclear physics and technology " .

1.2. The main users of the competency models are:

1.2.1 Combining professionals and employers in the area of professional activity.

1.2.2 Faculty teaching teams of higher education institutions responsible for high quality development, effective implementation and updating of the basic education programs, taking into account the achievements of science, technology and the social sphere in this education.

1.2.3 Students acquiring education program of the University aimed to shaping skills.

1.2.4 Vice-rectors, responsible within its competence for the quality of education.

1.3. Competence model is the basis for designing the contents of the master program Nuclear engineering.

## **2. GLOSSARY**

In this document, the terms and definitions are used in accordance with the Law "on education", federal law "on higher and postgraduate vocational education", as well as with the international instruments in the field of higher education:

*type of professional activity* – methods, techniques, the nature of the impact on the object of professional activity to his change, transformation;

*the competence of the* – ability to apply knowledge, skills and personal qualities for successful activity in a certain area;

*direction of education* – the totality of educational programs at various levels in the same occupational field;

*the object of professional activity* – system objects, phenomena, processes that sent impact;

*the scope of professional activities* – a set of objects of professional activity in their scientific, social, economic, productive unwinding;

*the basic education program* – a set of educational-methodological documentation that includes curriculum, work programs, training courses, subjects,

subjects (modules) and other materials that provide education and training quality of students, as well as training programs and production practices, academic calendar timetable and methodical materials, to ensure the implementation of appropriate educational technology;

*learning outcomes* – learned knowledge, skills and competencies mastered;

This document uses the following abbreviations:

HE-Higher education;

CM-the competence model;

GCC (OK)-general culture competences;

GPC (OIK)-general professional competences;

PC (ΠΚ)-professional competence;

PSC (ΠCK)-professional special competence

### **3. COMPETENCE MODEL**

3.1. Purpose of higher education in 14.04.02-nuclear physics and technology master program Nuclear Engineering in the field of education and upbringing of the person:

3.1.1. Purpose of higher education in 14.04.02-nuclear physics and technology master program Nuclear Engineering is:

- Education in the field of humanities, economics, mathematical knowledge, as well as training in scientific knowledge;

- Higher professional education to enable graduates profiled successfully work in the sphere of activities related to the design, analysis and evaluation of safety, economy, modern and future nuclear power installations, have sufficient system of analytical skills project management skills.

3.1.2. In the field of education the purpose of higher education is personality formation of socio-personal qualities of the graduates: commitment, communication, communicative and leadership qualities to work in creative teamwork, responsibility for the final result of their professional activities, enhancing the overall culture of professional activity.

3.2. Scope of professional activity of graduates

Area of professional activity of graduates in 14.04.02-nuclear physics and technology master program Nuclear Engineering includes

- studies, expert evaluation, design and technology, aimed at registration and processing of information, theory, creation and use of plants and systems in the field of Physics of nuclei, particles, nuclear installations, distribution and interaction of radiation with objects of animate and inanimate nature, ensuring nuclear and radiation safety, the safety of nuclear materials and facilities.

### 3.3. Objects of professional activity of graduates.

The objects of professional activity of graduates in 14.04.02-nuclear physics and technology "master's program" Nuclear Engineering "are

- atomic nucleus, elementary particles, nuclear reactors, nuclear materials, reactors, nuclear materials and their security systems, automatic control system of nuclear-physical installations, radiative forcing of ionizing radiation on man and the environment Wednesday, mathematical models for theoretical and experimental studies of the phenomena and regularities in the field of Physics of nuclear reactors, distribution and interaction of radiation with objects of animate and inanimate nature, ensuring the security of nuclear materials, facilities and installations of Atomic Energy and industry.

### 3.4. Types of professional activity of graduates :

- Research;
- Design;
- Expertise;
- Technological;
- Organization and management.

3.5. Objectives of professional activity of graduates in 14.04.02-nuclear physics and technology "master's program" Nuclear Engineering ":

#### 3.5.1. Research activities:

- development of methods for the registration of ionizing radiations and methods for measuring the quantitative characteristics of nuclear materials;

- creating theoretical models of interaction between neutrons and ionizing radiation with matter;
- creation of mathematical models describing processes in nuclear reactors;
- development of methods for increasing the safety of nuclear installations and materials;

#### 3.5.2. Design activities:

- formation of project objectives (programs) to address the challenges of criteria and indicators of achievement, building structure their relationships, identifying priorities for solving tasks, taking into account all aspects of the work;
- development of generalized solutions of this problem, an analysis of these options, forecasting consequences, finding compromise solutions in the face of mnogokriterial'nosti, uncertainty, planning of the project;
- the use of information technologies in the development of new plants and products;
- drafting of technical specifications, standards and technical descriptions of new installations and products;

#### 3.5.3. Expertise activities:

technical analysis and settlement-theoretical consideration of their conformity with the requirements of the legislation in the field of industry, environment and security and other normative acts;

- assessment of conformity of the proposed decision reached world level.

#### 3.5.4. Technological activities:

- development of methods of conducting nuclear physics experiments;
- development of nuclear installations and technologies with high efficiency, safety and security.

#### 3.5.5. Organization and management:

- organization of the work of performers, performing acceptance decisions under conditions of the spectrum of opinion, determine the order of execution of works;

- search for optimal solutions tailored to the requirements of quality, reliability and value, as well as the timing of performance, safety and environmental protection Wednesday;
- preparation of applications for patents, inventions and industrial designs and the valuation of intellectual activity;
- organization of work on 17,314 developing draft standards and certificates;
- organization of work for the implementation of the supervision in the manufacture, installation, commissioning, testing and commissioning of manufactured devices and installations;
- participation in marketing and business plans and implementing release promising and competitive capable devices and installations;
- development of plans and programmes at the enterprise innovation, coordinating personnel for the integrated innovative issues.

3.6. As a result of the development of the program "14.04.02 Nuclear Physics and technology" graduate receives qualification (degree of) Master and must possess the following competencies:

<b>GENERAL CULTURAL COMPETENCE OF MAGISTRATES</b>		
<b>№</b>	<b>Competency Code</b>	<b>The competence of the</b>
	GC-1	Ability for abstract thought, synthesis, analysis, and forecasting
	GC-2	Ability to act in non-standard situations, be responsible for the decisions you make about
	GC-3	the ability for self-development, self-realization, use creativity
	GC-4	Having an idea of the current state and problems of nuclear physics and nuclear technology, the history of their development

## PROFESSIONAL COMPETENCE OF MAGISTRATES

<b>General professional competences</b>		
	GP-1	Ability to formulate research goals and objectives, identify priorities for solving tasks, select and create evaluation criteria
	GP-2	Ability to apply modern methods of research, evaluate and present the results of the work performed
	GP-3	Ability to use a foreign language at work
	GP-1	Ability to execute research results in the form of articles, reports, scientific reports and presentations using computer typesetting systems and Office software packages
<b>Professional competence</b>		
<b>Scientific research competence</b>		
№	Competency code	The competence of the
	PC-1	Ability to create theoretical and mathematical models that describe the condensed State of matter, the distribution and interaction of radiation with matter, physics of kinetic phenomena or processes in reactors, particle accelerators, or effects of ionizing radiation on human material and environmental objects Wednesday
	PC-2	Willingness to create new methods of calculation of modern physical installations and devices, development of methods for the registration of ionizing radiation, evaluation methods of the quantitative characteristics of nuclear materials
	PC-3	Ability to use fundamental laws in physics of atomic nuclei and particles, condensed matter nuclear reactors substances, environment, at a level sufficient for self combining and synthesis of real ideas, creative expression
	PC-4	Ability to apply experimental, theoretical and computer research methods in the professional field
	PC-5	Ability to assess the prospects for the development of the nuclear industry, use its modern achievements and advanced technology in research works

	PC-6	Ability to independently perform experimental or theoretical research to address scientific and production tasks using modern technology and calculation methods and research
	PC-7	Ability to assess risk and to determine safety measures for new machines and technologies, prepare and analyze scenario potentially possible accidents, develop risk reduction techniques

### **Design competence**

№	Competency code	The competence of the
	PC-8	Ability to calculate, conceptual and design study of the modern physical installations and devices;
	PC-9	Willingness to apply optimization techniques, analysis, Multicriteria decisions search tasks, accounting for uncertainties in the design;
	PC-10	Ability to articulate technical assignments, use of information technology and application packages for the design and calculation of physical installations, use knowledge of methods of analysis of ecological and economic efficiency in the design and implementation of projects.

### **Expert competence**

№	Competency code	The competence of the
	PC-11	Ability to analyze technical and settlement and theoretical to integrate their compliance with the requirements of legislation in the field of industry, environment, technological, radiation and nuclear safety and other regulations;
	PC-12	Ability to objectively evaluate the proposed solution or project in relation to the modern world level, to prepare an expert opinion.

### **Industrial-technological competence**

№	Competency code	The competence of the
	PC-13	Ability to understand modern professional problems, modern nuclear technology, nuclear science and technology policy spheres of activity;
	PC-14	willingness to solve engineering and physical and economic objectives through applied programs packages;



15	the ability to exploit, to test and repair of modern physical installations.

### **Organizational and managerial competence**

№	Competency code	The competence of the
	PC-16	the ability to practically apply knowledge of basic concepts in the field of intellectual property, the rights of authors, the employer enterprise, patent holder, key provisions of patent law and copyright law of the Russian Federation;
	PC-17	the ability to search for sources of patent information, determine the purity developed objects, prepare primary materials to the patenting of inventions, official registration of computer programs and databases;
	PC-18	ability to manage personnel, taking into account the motives of conduct and ways of development of business conduct, the use of methods of assessing the quality and performance of staff;
	PC-19	ability to design and innovative business economic justification, content, structure and order of business plan development;
	PC-20	ability to develop plans and programs of the Organization innovation in the enterprise; carry out feasibility studies for innovative projects, manage programs development of new products and technologies;
	PC-21	willingness to develop an effective strategy and form an active risk management policy;
	PC-22	ability to analyze workflow as a control object;
	PC-23	willingness to cooperate with colleagues and work in a team, to the Organization of work collectives of artists.
	PC-24	ability to design, develop and implement new products and systems and to apply the theoretical knowledge in real engineering practice

### **Competences, inherent in the education program Nuclear engineering**

№	Competency code	The competence of the
	IC-1	Ability to create theoretical and mathematical models that describe the neutron-physical processes in NPI
	IC-2	The ability to use technological tools for calculating and measuring of fundamental physical characteristic of nuclear reactors and power installations

IC-3	Ability to analyze and further improve the security of nuclear installations
IC-4	Ability of the system to the analysis of the efficiency and competitiveness of the NPI created
IC-5	Ability to address the challenges associated with managing neutron physical parameters and operation of NPP
IC-6	Ability to use modern achievements and advanced technology to improve existing and prospective development NPI
IC-7	Ability to justify scientifically-technical and organizational decisions on the design and implementation of NPI

The head of the Master program,  
Professor Georgy Tikhomirov

Competence model of graduate

approved at meeting of Chair

«Theoretical and experimental physics nuclear reactors»

as of 07.04.2016, Protocol No. \_\_7\_\_.

AGREED:

Representatives of employers: