Final exam program

on discipline **"Modern computational methods in nuclear physics contents"** for 1st course doctoral students for specialty "6D060500 – Nuclear Physics"

The proposed program for the discipline **"Modern computational methods in nuclear physics contents"** is made according to the discipline's syllabus. The program determines the requirements for the levels of mastering the academic discipline, to which the student should be capable of learning: describe acquired knowledge (specifically) and it's understanding; interpret an understanding of the overall structure of the study field and the relations between its elements (specifically); generalize new knowledge in the context of basic knowledge, interpret its contents; create educational and social interaction and cooperation in the group; explain the solution of the problem, its importance; classify criticism and to criticize; decide to work in a team; combine the role of taken course in the implementation of individual learning paths. The system of descriptor verbs must be used during the formation of competences; design active and interactive methods which are recommended to ensure deeper understanding and learning of educational material; achieve learning outcomes of the course.

The aim of the course: learning the modern physics of atom nucleus and quantum mechanics of many-particle systems.

At the exam, students will be asked two theoretical questions (33 points each) and one practical question 34 point).

Exam questions:

1.	Explain introduction to the course "Programming and computer calculations in physics"	Lecture № 1
2.	Explain introduction to the system of Mathematica	Lecture № 1
3.	Analyze model of calculating	Lecture № 2
4.	Give definition and describe numbers and their representation and operations over them	Lecture № 2
5.	Explain arithmetic: the greatest common divisor and least common multiple	Lecture № 3
6.	Explain arithmetic: the decomposition of integers into prime factors	Lecture № 3
7.	Give definition of arithmetic: primenumbers	Lecture № 3
8.	Describe division with remainder, deductions, comparisons	Lecture № 4
9.	Explain the Chinese remainder theorem	Lecture № 4
10.	Analyze numerical functions	Lecture № 4
11.	Describe multimedia: geometry, graphics, cinema, sound	Lecture № 5
12.	Give the classification of factorization Factor Integer ECM	Lecture № 5
13.	Explain plotting	Lecture № 6
14.	Explain linear programming	Lecture № 6
15.	Give definition and describe nuclear forces	Lecture № 7
16.	Give definition of Nuclear Models	Lecture № 7
17.	Explain factorization of very large numbers	Lecture № 5
18.	Characterize nuclear forces and nuclear models	Lecture № 7
19.	Give the classification of Basic Concepts of Nuclear Physics	Lecture № 8
20.	Explain Toward a Unified Model Description of Nuclei	Lecture № 8
21.	Explain introduction to Nuclear Interactions and Reactions	Lecture № 9
22.	Describe Coulomb Excitation	Lecture № 9
23.	Explain Compound Nucleus Reactions	Lecture № 9
24.	Analyze Compound Nucleus Reactions and Other Reactions	Lecture № 9
25.	Describe Some Selected Applications of Nuclear Physics	Lecture № 9
26.	Characterize Radioactive Decay Laws	Lecture № 10
27.	Give definition of Alpha, Proton, Heavy Cluster	Lecture № 10
28.	Describe Spontaneous Fission Decays	Lecture № 10
29.	Explain Gamma Decay	Lecture № 10
30.	Give definition of Internal Conversion	Lecture № 10

31.	Explain Pair Production	Lecture № 10
32.	Describe Beta Decay	Lecture № 11
33.	Give definition of Radioactive Decay	Lecture № 11
34.	Explain Introduction to Nuclear Interactions and Reactions	Lecture № 11
35.	Characterize Reaction Kinematics	Lecture № 12
36.	Describe Fission and Fusion: Atomic Energy Utilization	Lecture № 12
37.	Explain Some Selected Applications of Nuclear Physics	Lecture № 13
38.	Analyze Nuclear Interactions and Reactions	Lecture № 13
39.	Give the classification of Magnetic Dipole Hyperfine Interaction	Lecture № 13
40.	Describe Electric Quadrupole Hyperfine Interaction	Lecture № 14
41.	Give defintion of Particle Families and Interactions	Lecture № 14
42.	Explain Conservation Rules	Lecture № 15
43.	Give definition and describe High-Energy Physics	Lecture № 15
44.	Describe Some Selected Applications of Nuclear Physics	Lecture № 13
45.	Explain Introduction to Nuclear Interactions and Reactions	Lecture № 11

Evaluation and attestation policy

Criteria-based evaluation:

Assessment of learning outcomes in correlation withdescriptors (verification of competence formation during midterm control andexaminations).

Summative evaluation:

evaluation of the presence and activity of the work in the classroom; assessment of the assignment, independent work of students, (project/casestudy/ program/...)

The formula for calculating the final grade.

$$\text{Final grade for the discipline} = \frac{\text{IC1} + \text{IC2}}{2} \cdot 0{,}6 + 0{,}1\text{MT} + 0{,}3\text{FC}$$

Below are the minimum estimates in percentage terms:

95% - 100%: A	90% - 94%: A-	85 % - 89%: B
80% - 84%: B	75% - 79%: B-	70% - 74%: C+
65% - 69%: C	60% - 64%: C-	55% - 59%: D+
50% - 54%: D-	0% -49%: F	

LITERATURES

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