

CURRICULUM

for foreign students

Speciality: 1-31 80 05 Physics

Profiling: Computational physics

Degree: Master

Period of Study: 1 year
Form of Education: full-time

I. Schedule of the educational process

[illegible]

II. Summary (in weeks)

Legend:

☐ — Academic Studies

X — Internship

[//] — Master's Thesis

□ — Exams

— Research

☐ — Vacation

III. Curriculum

No	The name of the module, academic discipline, course project (course work)	Exams	End-of-term test	Academic hours						Semesters						Competence Code
				Total	Total in class	As follows:				I year						
						Lectures	Laboratory work	Workshops	Seminar classes	1 semester, 17 weeks			2 semester, 10 weeks			
										Total	Total in class	Credits	Total	Total in class	Credits	
1.	State Component			666	184	136			48	468	184	15	198		6	
1.1	Modulus «Modern physics»															
1.1.1	Modern problems of physics	1		90	46	34			12	90	46	3				UC-1, 2, DPC -1
1.1.2	Computational methods in physics and information technology	1		90	46	34			12	90	46	3				UC-3, DPC -2
1.1.3	Functional materials	1		90	46	34			12	90	46	3				UC-3, DPC -3
1.1.4	Photonics of biological objects		1	90	46	34			12	90	46	3				UC-3, DPC -4
1.2	Modulus «Research activities associated with the subject of master's thesis»															UC-1-3
1.2.1	Research seminar		1,2	306						108		3	198		6	
2.	Higher Education Institution Component			810	402	236	90		76	450	210	15	360	192	12	
2.1	Modulus «Physical principles and objects of nanoelectronics»															
2.1.1	Nanoelectronics		1	90	42	32			10	90	42	3				SC -1
2.1.2	Computations in mathematical physics		1	90	42	32			10	90	42	3				SC -2
2.2	Optional modulus 1 of 2 ¹															
2.2.1	Modulus «Computational experiment in physics»															
2.2.1.1	Computer algebra systems in physics (on the example of Wolfram Mathematica) / Algebraic calculations in physics	1		90	42	32			10	90	42	3				SC -3
2.2.1.2	Computer simulation in optics and laser physics / Controlled diffusion transport	1		90	42	32			10	90	42	3				SC -4
2.2.1.3	Laboratory special training "Modeling optical phenomena" / Laboratory special training "Development of applications for high performance computing"		1	90	42		42			90	42	3				SC -4
2.3	Optional modulus 1 of 2 ¹															
2.3.1	Modulus «Simulation of dynamic processes»															
2.3.1.1	Nonlinear Dynamics / Introduction to the theory of self-organization	2		90	48	36			12				90	48	3	SC -5
2.3.1.2	Mathematical modeling in hydro- and gas dynamics / Computational methods in continuum mechanics	2		90	48	36			12				90	48	3	SC -6
2.3.1.3	Statistical data analysis / Data mining and acquisition	2		90	48	36			12				90	48	3	SC -7
2.3.1.4	Laboratory special training "Modeling in the physics of the atmosphere" / Laboratory special training "Modern approaches to Big Data analysis"		2	90	48		48						90	48	3	SC -6
3.	Optional Subjects															
3.1	Creative Teaching Techniques at Higher School/ Pedagogy and Psychology of Higher Education		/1	/108	/56	/30		/26		/108	/56	/3				UC-4
4.	Series of Disciplines for Candidate Exams and Additional Training															
4.1	Philosophy and Methodology of Science ²	/2		/240	/104	/60			/44	/140	/60		/100	/44	/6	UC-5
4.2	Foreign Language ² / Russian language for international communication	/2	/1	/220	/140			/140		/110	/70	/3	/110	/70	/3	UC-6
4.3	Information Technologies: Basics ²		/1	/108	/72	/36	/36			/108	/72	/3				UC-7

Number of Hours	1476	586	372	90		124	918	394	30	558	192	18	
Number of Hours per Week								23			19		
Number of Exams	8							5			3		
Number of End-of-term tests	7							5			2		

IV. Internship				V. Research			VI. Final Certification
Internship Title	Semester	Weeks	Credits	Semester	Weeks	Credits	Master's Thesis
Research	2	4	6	2	4	6	

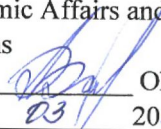
VII. Competence Matrix

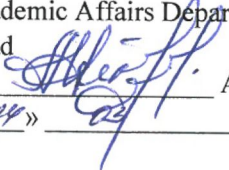
Competence Code	Competence	Module Code, Discipline Code
UC-1	Ability to use the scientific cognition techniques (analysis, comparison, systematization, abstracting, modeling, data verification, decision-making, etc.) in independent research activities, to generate and to realize innovative ideas)	1.1.1, 1.2
UC-2	Ability to assess the functionality of complex physical equipment, the limits of applicability of theoretical models and use this in planning experiments and performing theoretical calculations	1.1.1, 1.2
UC-3	Be capable of innovative, research and educational activities, to develop new research methods, to change the profile of research activities, to put forward independent hypotheses	1.1.2-1.1.4, 1.2
UC-4	Ability to realize pedagogical activities in educational institutions; to master and introduce the effective educational and information communication technologies, pedagogical innovations	3.1
UC-5	Mastering scientific cognition methods; ability to analyze the content and level of philosophical-methodological problems when accomplishing the tasks of research and innovative activities	4.1
UC-6	Mastering of foreign languages for communication in interdisciplinary and research fields, in different forms of international collaboration, research and innovative activities	4.2
UC-7	Skills to use advanced information technologies for solving of research and innovative problems	4.3
DPC -1	Ability to use in professional activity the methods of classical and quantum field theories, to carry out both analytical and numerical calculations using modern models of gravity and elementary particles, to verify the calculation results on the basis of fundamental physical laws	1.1.1
DPC -2	Ability to use modern computational algorithms, software systems and information technologies to solve current research problems in the educational process	1.1.2
DPC -3	Ability to describe the electrical, magnetic and optical properties of functional materials based on data on their atomic structure, to determine the areas of use of functional materials based on their electrical, magnetic and optical properties	1.1.3
DPC -4	Abilities to demonstrate knowledge of the photophysical properties of biological objects and apply optical methods to study the structural and functional properties of nanobiotechnology objects	1.1.4
SC-1	Ability to use modern concepts of quantum mechanics and condensed matter physics to analyze the physical mechanisms of the functioning of nanoelectronic instruments and devices	2.1.1
SC -2	Ability to use modern methods of mathematical physics to compile mathematical models for performing numerical calculations	2.1.2
SC -3	Ability to apply computer algebra systems in theoretical research and experimental data processing	2.2.1.1
SC -4	Ability to develop mathematical models of physical phenomena and processes, apply numerical methods on high-performance computing systems.	2.2.1.2, 2.2.1.3
SC -5	Ability to apply nonlinear dynamics methods to construct hierarchical models of physical processes	2.3.1.1
SC -6	Ability to apply the provisions of the continuous media physics for the calculation of hydro and gas dynamic processes	2.3.1.2
SC -7	Ability to perform mathematical analysis of big data and use statistical calculations in the analysis of the results of scientific experiments	2.3.1.3, 2.3.1.4

It is developed on the basis of the standard curriculum, approved 21.03.2019 yr. (Registration number № G 31-2-005/пр.-тип.)

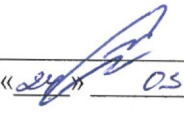
¹ The enumerated modules and their contents are annually revised and qualified by the Faculty Council in accordance with the proposals of the relevant departments and personnel recruiting organizations
² Series of Disciplines for Candidate Exams and Additional Training «Philosophy and Methodology of Science», «Foreign Language», «Information Technologies: Basics» are studied according to the choice of a student. In the general educational disciplines "Philosophy and Methodology of Science" and "Foreign Language" the form of the current certification is the candidate exam, in the general education discipline "Fundamentals of Information Technologies" the form of the current certification is the candidate's test

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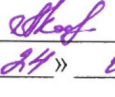

«24» 03 2021

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