



National Research University Higher School of Economics (HSE)

Basic Curriculum

Field of study 03.03.02 Physics
Educational Programme "Physics"

Specializations: "Condensed Matter Physics", "Low Temperature Physics", "Nanoelectronics and Photonics", "Quantum Optics and Nanophotonics", "Quantum Technologies", "Space Physics", "The Teaching of Modern Physics", "Theoretical Physics"

Implementing unit: Faculty of Physics, HSE - Moscow

APPROVED
26.04.2024
Vice Rector
ROSHCHIN S.Y.
Signed with EDS

Years of Study: 2024/2025 - 2027/2028

Length of Programme: 4 years

Mode of Study: Full Time

Degree: Bachelor's degree

Block Code	Course	Subject type	Credits	Credits by Years				Planned Educational Programme Development Results
				1	2	3	4	
	Degree Programme		240,00	60,00	60,00	60,00	60,00	
	Major		154,00	43,00	31,00	46,00	34,00	
	Core Professional Block (Major)		102,00	43,00	31,00	21,00	7,00	
1	Chemistry for Physicists	C	4,00		4,00			GPC-1, GPC-2, UC-1
2	Optics	C	4,00		4,00			GPC-2, PC-3, PC-6, UC-1, UC-3
3	Field Theory	C	4,00		4,00			GPC-2, PC-2, UC-1, UC-2
4	Quantum Mechanics	C	6,00		3,00	3,00		GPC-3, PC-2, UC-1, UC-3
5	Probability Theory	C	3,00		3,00			PC-2, UC-1, UC-3
6	Mathematical Physics	C	3,00		3,00			GPC-3, PC-5, UC-1, UC-3
7	Theory of Complex Functions	C	4,00		4,00			PC-6, UC-1, UC-3
8	Computational mathematics for physicists	C	3,00			3,00		PC-2, UC-1, UC-3
9	Fundamentals of Modern Physics: Quantum Microphysics	C	3,00			3,00		PC-1, PC-2, UC-1, UC-3
10	Modern Physics: Introduction to Astrophysics	C	3,00			3,00		PC-1, PC-2, UC-1, UC-3
11	Modern Physics: Introduction to Solid State Physics	C	3,00			3,00		PC-1, PC-2, UC-1, UC-3
12	Basics of Modern Physics: Introduction to Molecular Biology	C	3,00			3,00		PC-1, PC-2, UC-1, UC-3
13	Introduction to Physics of Continuous Media	C	3,00				3,00	PC-1, PC-2, UC-1, UC-3
14	Electrodynamics of Condensed Matter	C	4,00				4,00	PC-2, PC-6, UC-1, UC-3
15	Statistical Physics	C	3,00			3,00		PC-3, PC-6, UC-1, UC-3
16	Thermodynamics and Molecular Physics	C	3,00		3,00			GPC-2, PC-2, UC-1, UC-2
17	Analytical Approximation Methods	C	3,00	3,00				GPC-3, PC-4, PC-6, UC-1, UC-3
18	Elements of Mathematical Methods of Physics	C	4,00	4,00				GPC-1, PC-1, PC-4, UC-1, UC-3
19	Computer Science	C	3,00	3,00				GPC-3, UC-1, UC-3

20	Mechanics	C	4,00	4,00				GPC-1, PC-2, UC-1, UC-3
21	Electricity and Magnetism	C	4,00	4,00				GPC-2, PC-3, UC-1, UC-3
22	Analytical Mechanics	C	4,00	4,00				PC-4, UC-1, UC-3
23	Introduction into Python	C	3,00	3,00				PC-1, PC-6, UC-1, UC-3
24	Calculus	C	13,00	10,00	3,00			GPC-2, PC-2, UC-1, UC-2
25	Linear Algebra	C	4,00	4,00				PC-1, PC-5, UC-1, UC-3
26	Differential Equations	C	4,00	4,00				GPC-2, PC-1, UC-1, UC-3
	Elective Professional Block (Major)		52,00			25,00	27,00	
	Research seminar		7,00			7,00		
	Research seminar "Condensed matter physics"		7,00			7,00		
1	Research Seminar: High Vacuum Equipment and Thin Film Deposition Technologies	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Theoretical physics"		7,00			7,00		
1	Research Seminar: Langevin Dynamics and Kinetic of Equilibrium and Non-Equilibrium Systems	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Quantum technologies"		7,00			7,00		
1	Research Seminar "Local Probe Microscopy"	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Nanoelectronics and photonics"		7,00			7,00		
1	Research Seminar "Modern Methods of Electrophysical Measurements"	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Space physics"		7,00			7,00		
1	Research Seminar: Fundamentals of Plasma Physics	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Low-temperature physics"		7,00			7,00		
1	Research Seminar: Test and Measurements	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Research seminar "Quantum optics and nanophotonics"		7,00			7,00		
1	Research Seminar: Laboratory Works	C	7,00			7,00		GPC-2, PC-1, PC-4, PC-6, UC-5, UC-6, UC-8, UC-9
	Specialization "Teaching of modern physics"		5,00			5,00		
1	Project Seminar "Pedagogical Workshop"	C	5,00			5,00		GPC-2, GPC-3, PC-6, UC-1, UC-4
	Вариативная часть, в т.ч. дисциплины по выбору студента		15,00			15,00		
	Optional specialized part "Quantum optics and nanophotonics"		15,00			15,00		
1	Quantum Optics and Photonics	C	15,00			15,00		GPC-3, PC-6, UC-2
	Optional specialized part "Quantum technologies"		15,00			15,00		
1	Introduction to the quantum theory of information	C	15,00			15,00		GPC-3, PC-5, PC-6, UC-2
	Optional specialized part "Nanoelectronics and photonics"		15,00			15,00		
1	Kinetics of Electrons in Solids	C	15,00			15,00		PC-4, UC-1, UC-2, UC-3

	Optional specialized part "Theoretical physics"		15,00			15,00		
1	Advanced Topics in Mathematical Physics	C	15,00			15,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "condensed matter physics"		15,00			15,00		
1	Introduction to Surface Physics	C	15,00			15,00		GPC-3, PC-5, UC-2
	Optional specialized part "Space physics"		15,00			15,00		
1	Fundamentals of the Kinetic Theory of Gases	C	15,00			15,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "Low-temperature physics"		15,00			15,00		
1	Selected Topics of Thermodynamics and Statistical Physics	C	15,00			15,00		GPC-3, PC-2, PC-4, PC-5, UC-2
	Variable profile part "Teaching modern physics"		15,00			15,00		
1	Modern Methods of Teaching Physics at School	C	15,00			15,00		GPC-1, GPC-2, GPC-3, PC-1, PC-2, PC-3, PC-5, UC-2, UC-4, UC-6, UC-8
	Вариативная часть, в т.ч. дисциплины по выбору студента		24,00			24,00		
	Optional specialized part "Quantum optics and nanophotonics"		24,00			24,00		
1	Fundamentals of Modern Optics	C	24,00			24,00		GPC-1, PC-2, PC-3, PC-6, UC-2
	Optional specialized part "Quantum technologies"		24,00			24,00		
1	Quantum Cryptography	C	24,00			24,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "Nanoelectronics and photonics"		24,00			24,00		
1	Topology and Symmetry in Physics	C	24,00			24,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "Theoretical physics"		24,00			24,00		
1	Diagrammatic Technique for Many-Body Systems	C	24,00			24,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "condensed matter physics"		24,00			24,00		
1	Physics of Metals	C	24,00			24,00		PC-2, PC-3, PC-6, UC-2
	Optional specialized part "Space physics"		24,00			24,00		
1	Statistical Analysis of Space Experiment Data	C	24,00			24,00		PC-4, UC-1, UC-2, UC-3
	Optional specialized part "Low-temperature physics"		24,00			24,00		
1	Low Temperature Physics	C	24,00			24,00		GPC-3, PC-2, UC-2
	Variable profile part "Teaching modern physics"		24,00			24,00		
1	Olympiad Physical Practicum	C	24,00			24,00		GPC-1, GPC-2, GPC-3, PC-1, PC-2, PC-3, UC-2, UC-4, UC-5, UC-8
	Вариативная часть. Блок 1		3,00			3,00		
1	Actual problems of modern physics	C	3,00			3,00		GPC-3, PC-2, UC-8, UC-9
	Elective Components (Courses)		3,00			3,00		
1	Mastering Programming with MATLAB	C	3,00			3,00		UC-1, UC-4
	Internship		44,00	10,00	12,00	3,00	19,00	
	Professional Internship		5,00			5,00		
1	Science and Research Internship	C	5,00			5,00		GPC-2, GPC-3, PC-4, PC-5, UC-2, UC-3
2	Teaching Internship	E	2,00			2,00		PC-6, UC-1, UC-4
	Project Internship		3,00			3,00		
1	Laboratory Work on Modern Physics	C	3,00			3,00		GPC-1, GPC-2, PC-1, PC-2, UC-1, UC-3, UC-4, UC-8

	Research Internship		36,00	10,00	12,00		14,00	
1	Educational Internship (Introductory Training)	C	2,00	2,00				GPC-2, PC-9, UC-1
2	Educational Internship	C	2,00		2,00			GPC-1, GPC-2, PC-4, PC-5, UC-2
3	Preparation of Graduation Thesis	C	8,00				8,00	GPC-1, GPC-2, GPC-3, PC-1, PC-10, PC-2, PC-3, PC-4, PC-5, PC-6, PC-7, PC-8, PC-9, UC-1, UC-10, UC-11, UC-2, UC-3, UC-4, UC-5, UC-6, UC-7, UC-8, UC-9
4	Laboratory Work on Mechanics	C	4,00	4,00				GPC-1, GPC-2, PC-1, PC-2, PC-3, UC-4, UC-7
5	Laboratory Work on Electricity and Magnetism	C	4,00	4,00				GPC-2, GPC-3, PC-1, PC-2, PC-3, UC-4, UC-7
6	Laboratory Work in Optics	C	5,00		5,00			GPC-1, GPC-2, PC-1, PC-2, PC-3, UC-4, UC-7
7	Laboratory Work on Thermodynamics and Molecular Physics	C	5,00		5,00			GPC-1, GPC-2, GPC-3, PC-1, PC-2, UC-4, UC-7
8	Research project	C	6,00				6,00	GPC-1, GPC-3, PC-1, PC-6
	General Courses		14,00	7,00	4,00		3,00	
	Core General Courses		2,00	1,00	1,00			
1	Safe Living Basics	C	1,00	1,00				GPC-3, UC-1
2	Physical Training	C	1,00		1,00			UC-7, UC-8
	Optional General Courses		12,00	6,00	3,00		3,00	
1	Economics	C	3,00				3,00	GPC-3, PC-8, PC-9
2	Legal Literacy	C	3,00		3,00			GPC-3, PC-1, UC-1, UC-2
3	Russian History	C	4,00	4,00				PC-1, UC-1, UC-2
4	Foundations of Russian Statehood	C	2,00	2,00				UC-1, UC-10, UC-3, UC-5
	Minor		20,00		10,00	10,00		
1	Minor	C	20,00		10,00	10,00		GPC-3, PC-1, UC-1
	English		1,00				1,00	
	Examinations		1,00				1,00	
1	Independent English Exam (offered in a foreign language)	C						UC-4, UC-5
2	Project Proposal (offered in a foreign language)	C	1,00				1,00	GPC-1, GPC-2, UC-1, UC-4
3	English Language Integrative Exam (offered in a foreign language)	C						UC-1, UC-4
	Optional Courses							
1	English Language (offered in a foreign language)	O	14,00	8,00	6,00			GPC-3, UC-4
2	Academic Writing (English) (offered in a foreign language)	O	2,00				2,00	PC-3, UC-1
	Data Culture		4,00		3,00	1,00		
1	Processing and Data Analysis in Physics	C	3,00		3,00			GPC-3, PC-4, UC-1, UC-3
2	Independent Programming Test. Intermediate	C						GPC-3, UC-1
3	Data Science, AI and Generative Models Independent Test. Intermediate	C	1,00			1,00		GPC-2, GPC-3, UC-1

4	Independent Digital Literacy Test	C					GPC-2, GPC-3, UC-1
5	External Examinations on Digital Skills. Entry-level	C					GPC-3
6	External Examinations on Digital Skills. Intermediate Level	C					PC-1, UC-1
7	External Examinations on Digital Skills. Final Level	C					PC-1, UC-1
	Final State Certification (FSC)			3,00			3,00
	Thesis Work			3,00			3,00
1	Presenting of Graduation Thesis	C		3,00			3,00 GPC-1, GPC-2, GPC-3, PC-1, PC-10, PC-2, PC-3, PC-4, PC-5, PC-6, PC-7, PC-8, PC-9, UC-1, UC-10, UC-11, UC-2, UC-3, UC-4, UC-5, UC-6, UC-7, UC-8, UC-9

Curriculum agreed:

Academic Supervisor	Kuntsevich A.Y.	22.04.2024
Dean	TRUNIN M.R.	22.04.2024
Head of Centre for Educational Model Design	LEPESHKIN I.A.	26.04.2024

* Subject type:

Compulsory course	C
Elective course	E
Optional course	O