



National Research University Higher School of Economics (HSE)

Basic Curriculum

Field of study 01.03.02 Applied Mathematics and Information Science
Educational Programme "Applied Mathematics and Information Science"

Specializations: "Choice and Decision Theory", "Data Analysis and Intelligent Systems", "Distributed Systems", "Industrial Software Engineering", "Machine Learning and Applications", "Mathematical and Computational Engineering in Science and Business", "Theoretical Computer Science"

Implementing unit: Faculty of Computer Science, HSE - Moscow

APPROVED
29.05.2023
Vice Rector
ROSHCHIN S.Y.
Signed with EDS

Years of Study: 2023/2024 - 2026/2027

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		164,00	49,00	44,00	34,00	37,00	
	Core Professional Block (Major)		83,00	49,00	30,00	4,00		
	Дискретная математика		6,00	6,00				
1	Discrete Mathematics	E	6,00	6,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Discrete Mathematics	E	6,00	6,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Линейная алгебра и геометрия		10,00	10,00				
1	Linear Algebra and Geometry	E	10,00	10,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Linear Algebra and Geometry	E	10,00	10,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Алгебра		3,00	3,00				
1	Algebra	E	3,00	3,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Algebra	E	3,00	3,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Математический анализ		10,00	10,00				
1	Calculus	E	10,00	10,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Calculus	E	10,00	10,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	-		3,00	3,00				
1	Number Theory (advanced course)	E	3,00	3,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Number Theory	E	3,00	3,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Probability Theory		5,00		5,00			
1	Probability Theory	E	5,00		5,00			GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Probability Theory (advanced course)	E	5,00		5,00			GPC-1, GPC-3, PC-1, UC-1, UC-2
	Математический анализ 2		8,00		8,00			
1	Calculus 2	E	8,00		8,00			GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Calculus 2	E	8,00		8,00			GPC-1, GPC-3, PC-1, UC-1, UC-2

	Методы оптимизации		4,00			4,00	
1	Optimization Methods	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, PC-4, UC-1, UC-2
2	Optimization in Machine Learning	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, PC-4, UC-1, UC-2
	-		8,00		8,00		
1	Computer Architecture and Operating Systems	C	8,00		8,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, UC-1, UC-2
	Programming		21,00	17,00	4,00		
	-		21,00	17,00	4,00		
1	Algorithms and Data Structures 2	E	4,00		4,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
2	C++ Programming Language	E	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
3	Algorithms and Data Structures	E	13,00	13,00			GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
	-		21,00	17,00	4,00		
1	Algorithms and Data Structures 2	E	4,00		4,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
2	Python Programming Language	E	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
3	C++ Programming Language	E	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
4	Algorithms and Data Structures	E	9,00	9,00			GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
	Mathematical Statistics		5,00		5,00		
1	Mathematical Statistics	E	5,00		5,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Mathematical Statistics (advanced course)	E	5,00		5,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
	Elective Professional Block (Major)		81,00		14,00	30,00	37,00
	Обязательная дисциплина (2 курс)		3,00		3,00		
1	Modern Software Engineering Practices	C	3,00		3,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, PC-6, PC-7, UC-1, UC-2
	Обязательная дисциплина по выбору (2 курс 1 семестр)		5,00		5,00		
1	Mathematical Logic	E	5,00		5,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
2	C++ Programming Language	E	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, UC-1, UC-2
3	Python Programming Language (advanced course)	E	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, UC-1, UC-2
4	Rust Programming Language	E	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, UC-1, UC-2
	Обязательная дисциплина по выбору (2 курс 2 семестр)		6,00		6,00		
1	Differential Equations	E	6,00		6,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Fundamentals of Matrix Computations	E	6,00		6,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
3	Functional Analysis	E	6,00		6,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
	Обязательная дисциплина на 3 курсе		4,00			4,00	

1	Machine Learning 1	C	4,00			4,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
	Обязательная дисциплина по выбору (4 курс)		5,00				5,00	
1	DevOps	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	How to Win a Data Science Competition: Learn from Top Kagglers	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	Introduction to Differential Geometry	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
4	Computational Photography Algorithms for Capturing Color Images	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Специализации		38,00			15,00	23,00	
	Специализация "Машинное обучение и приложения"		38,00			15,00	23,00	
1	Machine Learning 2	C	6,00			6,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
2	Applied Statistical Data Analysis	C	5,00			5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
3	Deep Learning	C	5,00				5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
4	Large-Scale Machine Learning	C	4,00				4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
5	Research Seminar "Machine Learning and Applications"	C	4,00			4,00		GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
6	Research Seminar "Machine Learning and Applications 2"	C	5,00				5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
7	-	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
8	-	E	4,00				4,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Специализация "Теоретическая информатика"		38,00			15,00	23,00	
1	Research Seminar "Theoretical Informatics"	C	4,00			4,00		GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Research Seminar "Theoretical Informatics 2"	C	5,00				5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Combinatorial Constructions in Theoretical Computer Science	C	6,00			6,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
4	Theory of Computation	C	5,00			5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
5	One-Way Functions and Their Applications	C	5,00				5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	A Theorist's Toolkit	C	4,00				4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	-	E	5,00				5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2

8	-	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Специализация "Распределенные системы"		38,00			15,00	23,00
1	Research Seminar "Distributed Systems"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Research Seminar "Distributed Systems 2"	C	5,00				5,00
							GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Theory and Practice of Concurrency	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
4	Distributed Systems	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
5	Methods and Systems for Processing Big Data	C	5,00				5,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
6	Theory of Fault-Tolerant Distributed Systems	C	5,00				5,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
7	Cloud Computing	C	4,00				4,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
8	Introduction to Blockchain	C	4,00				4,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
	Специализация "Анализ данных и интеллектуальные системы"		38,00			15,00	23,00
1	Research Seminar "Data Analysis and Artificial Intelligence"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Research Seminar "Data Analysis and Artificial Intelligence 2"	C	5,00				5,00
							GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Core Concepts in Data Analysis	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
4	Combinatorics, Graphs and Boolean Logic	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
5	Automatic Text Processing	C	5,00				5,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Applied Graph Theory	C	5,00				5,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	Semantic Technologies	C	4,00				4,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
8	Analysis and Visualization of Networks	C	4,00				4,00
							GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
	Специализация "Анализ и принятие решений"		38,00			15,00	23,00
1	Research Seminar "Applied Problems of Decision Making"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Research Seminar "Applied Problems of Decision Making 2"	C	5,00				5,00
							GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Choice and Decision Theory	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
4	Operations Research and Game Theory	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2

5	Systems Analysis	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Individual and Social Choice	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	Cooperative Games	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
8	Time Series and Stochastic Processes	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
	Специализация "Математическая инженерия в науке и бизнесе"		38,00			15,00	23,00
1	Research Seminar "Mathematical and Computational Engineering in Science and Business"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Research Seminar "Mathematical and Computational Engineering in Science and Business 2"	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Applied Differential Equations	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
4	Mathematical Modeling	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
5	Complex Systems Theory	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Stochastic Processes	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	-	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
8	-	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	-		38,00			15,00	23,00
1	Project Seminar "Software Engineering"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
2	Project Seminar "Software Engineering 2"	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
3	Fault-tolerant System Design	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
4	Fault-tolerant System Design 2	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
5	Systems Reliability Engineering	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
6	Systems Reliability Engineering 2	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
7	-	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
8	-	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Дисциплины по выбору (Блок 1)		5,00			5,00	

1	Computer Systems Security	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Computer Networks	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	SQL Language	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Дисциплины по выбору (Блок 2)		6,00			6,00		
1	Java Programming	E	6,00			6,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Combinatorial Optimization	E	6,00			6,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	Chapters in Applied Statistics	E	6,00			6,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Дисциплины по выбору (Блок 3)		5,00			5,00		
1	Bayesian Methods for Machine Learning	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Statistical Learning Theory	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	Unstructured Data Analysis	E	5,00			5,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Дисциплины по выбору (Блок 4)		4,00			4,00		
1	Reinforcement Learning	E	4,00			4,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Generative Models in Machine Learning	E	4,00			4,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	3D Computer Vision	E	4,00			4,00		GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	Internship		33,00	4,00	5,00	8,00	16,00	
	Professional Internship		7,00	4,00		3,00		
1	Educational Internship	C	4,00	4,00				GPC-4, PC-2, PC-3, PC-4, PC-5, PC-7, UC-1, UC-2, UC-3, UC-4, UC-6, UC-8
2	Work Experience Internship	C	2,00			2,00		PC-1, PC-2, PC-3, PC-4, UC-10, UC-11, UC-9
3	Educational Internship	C	1,00			1,00		PC-1, PC-2, PC-3, PC-4, PC-5, PC-7, UC-1, UC-2, UC-6
	Project Internship		10,00		5,00	5,00		
1	-	C	5,00		5,00			GPC-4, PC-2, PC-3, PC-4, PC-5, PC-7, UC-1, UC-2, UC-3, UC-4
2	-	C	5,00			5,00		GPC-2, PC-1, UC-4, UC-5, UC-6
	Research Internship		16,00				16,00	
1	Graduation Internship	C	6,00				6,00	PC-1, PC-2, PC-3, PC-4
2	Preparation of Graduation Thesis	C	10,00				10,00	PC-1, PC-4, PC-5, UC-1, UC-2, UC-3, UC-4, UC-6
	General Courses		14,00	7,00	1,00	3,00	3,00	
	Core General Courses		2,00	1,00	1,00			

* Subject type:

Compulsory course

C

Elective course

E

Optional course

O