



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", "Theoretical Computer Science"

Implementing unit: Faculty of Computer Science, HSE - Moscow

APPROVED
18.05.2022
Vice Rector
ROSHCHIN S.Y.
Signed with EDS

Years of Study: 2022/2023 - 2025/2026

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		166,00	47,00	44,00	38,00	37,00	
	Core Professional Block (Major)		80,00	47,00	27,00	6,00		
	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
	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 (Advanced Course)	E	6,00	6,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Линейная алгебра и геометрия		8,00	8,00				
1	Linear Algebra and Geometry	E	8,00	8,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Linear Algebra and Geometry (Advanced Course)	E	8,00	8,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
	Алгебра		3,00	3,00				
1	Algebra (Advanced Course)	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 (Advanced Course)	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	E	3,00	3,00				GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Number Theory (advanced course)	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		3,00		3,00		
1	Calculus 2	E	3,00		3,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
2	Calculus 2	E	3,00		3,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
	Методы оптимизации		6,00			6,00	
1	Optimization Methods	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, PC-4, UC-1, UC-2
2	Optimization in Machine Learning	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, PC-4, UC-1, UC-2
3	Combinatorial Optimization	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
	-		11,00		11,00		
1	Computer Architecture	C	5,00		5,00		GPC-1, GPC-4, PC-3, PC-7, UC-1
2	Operating Systems	C	6,00		6,00		GPC-1, GPC-4, PC-3, PC-7, UC-1
	Programming		20,00	17,00	3,00		
	-		20,00	17,00	3,00		
1	Algorithms and Data Structures 2	E	3,00		3,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
2	C++ Programming Language	C	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
3	Algorithms and Data Structures	C	13,00	13,00			GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
	-		20,00	17,00	3,00		
1	Algorithms and Data Structures 2	E	3,00		3,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
2	C++ Programming Language	C	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
3	Algorithms and Data Structures	C	9,00	9,00			GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
4	Python Programming Language	C	4,00	4,00			GPC-4, PC-3, UC-1, UC-2
	Elective Professional Block (Major)		86,00		17,00	32,00	37,00
	Обязательная дисциплина по выбору (2 курс 1 семестр)		5,00		5,00		
1	C++ Programming Language	E	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-2, PC-3, UC-1, UC-2
2	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
3	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)		12,00		12,00		
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
4	Complex Analysis	E	6,00		6,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
5	Discrete Mathematics 2	E	6,00		6,00		GPC-1, GPC-3, PC-1, UC-1, UC-2
	Обязательная дисциплина на 3 курсе		6,00			6,00	

1	Machine Learning 1	C	6,00			6,00		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 (offered in a foreign language)	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 (offered in a foreign language)	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	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
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	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
4	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
5	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
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	Theory of Computation (offered in a foreign language)	C	5,00			5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
2	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
3	Research Seminar "Theoretical Informatics"	C	4,00			4,00		GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
4	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
5	A Theorist's Toolkit (offered in a foreign language)	C	4,00				4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Research Seminar "Theoretical Informatics 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 "Распределенные системы"		38,00		15,00	23,00	
1	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
2	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
3	Research Seminar "Distributed Systems"	C	4,00		4,00		GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
4	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
5	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
6	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
7	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
8	Research Seminar "Distributed Systems 2"	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
	Специализация "Анализ данных и интеллектуальные системы"		38,00		15,00	23,00	
1	Core Concepts in Data Analysis	C	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
2	Combinatorics, Graphs and Logic (offered in a foreign language)	C	6,00		6,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
3	Research Seminar "Data Analysis and Artificial Intelligence" (offered in a foreign language)	C	4,00		4,00		GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
4	Automatic Text Processing	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
5	Applied Graph Theory (offered in a foreign language)	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Semantic Technologies (offered in a foreign language)	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	Analysis and Visualization of Networks (offered in a foreign language)	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
8	Research Seminar "Data Analysis and Artificial Intelligence 2" (offered in a foreign language)	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
	Специализация "Анализ и принятие решений"		38,00		15,00	23,00	
1	Choice and Decision Theory (offered in a foreign language)	C	5,00		5,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
2	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
3	Operations Research and Game Theory (offered in a foreign language)	C	6,00		6,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
4	Systems Analysis (offered in a foreign language)	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2

5	Individual and Social Choice (offered in a foreign language)	C	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
6	Cooperative Games (offered in a foreign language)	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
7	Time Series and Stochastic Processes (offered in a foreign language)	C	4,00			4,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
8	Research Seminar "Applied Problems of Decision Making 2" (offered in a foreign language)	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
	-		38,00			15,00	23,00
1	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
2	Fault-tolerant System Design 2	C	6,00			6,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, PC-6, UC-1, UC-2
3	Project Seminar "Software Engineering"	C	4,00			4,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
4	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
5	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
6	-	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
7	-	E	4,00			4,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
8	Project Seminar "Software Engineering 2"	C	5,00			5,00	GPC-1, PC-1, PC-4, PC-5, UC-1, UC-2, UC-3
	Дисциплины по выбору (Блок 1)		5,00			5,00	
1	SQL Language	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Database Systems	E	5,00			5,00	GPC-1, GPC-4, PC-2, PC-3, PC-7, UC-1
3	Functional Programming	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
4	Developing Microservices with Golang	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
5	Foundations of Tensor Computations	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
6	Operating Systems 2	E	5,00			5,00	GPC-1, GPC-4, PC-3, PC-7, UC-1
7	Types and Programming Languages	E	5,00			5,00	GPC-1, GPC-4, PC-1, PC-2, PC-3, PC-7, UC-1
8	Computer Systems Security	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
9	Statistical Learning Theory (offered in a foreign language)	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
10	Scala Programming Language	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2

11	Applied Statistical Data Analysis	E	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2
12	Decision Making under Risk and Uncertainty	E	5,00			5,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
13	Distributed Systems	E	5,00			5,00	GPC-1, GPC-2, GPC-3, GPC-4, PC-1, PC-2, PC-3, UC-1, UC-2
Дисциплины по выбору (Блок 2)			6,00			6,00	
1	Computer Networks	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
2	Java Programming	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
3	Combinatorial Optimization	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
4	Machine Learning 2	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
5	Time Series Modeling	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
6	Data Analytics	E	6,00			6,00	GPC-1, GPC-4, PC-1, PC-3, PC-7, UC-1, UC-3, UC-4
7	Topological data analysis	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, UC-1, UC-2
8	Quantitative Finance	E	6,00			6,00	GPC-1, GPC-4, PC-1, PC-3, PC-7, UC-1, UC-3, UC-4
9	Stochastic Calculus	E	6,00			6,00	GPC-1, GPC-3, PC-1, UC-1, UC-2
10	Recommender Systems	E	6,00			6,00	GPC-2, GPC-3, PC-1, UC-1, UC-2
11	Deep Learning Methods in Natural Sciences	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, PC-2, UC-1
12	Generative Models in Machine Learning (advanced course)	E	6,00			6,00	GPC-1, GPC-2, GPC-3, PC-1, PC-2, UC-1
13	Machine learning in applied problems	E	6,00			6,00	GPC-1, GPC-4, PC-1, PC-3, PC-7, UC-1, UC-3, UC-4
14	Process-mining	E	6,00			6,00	GPC-1, GPC-4, PC-1, PC-3, PC-7, UC-1, UC-3, UC-4
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 (offered in a foreign language)	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		31,00	4,00	5,00	7,00	15,00	
	Professional Internship		6,00	4,00		2,00		
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
	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		15,00				15,00	
1	Preparation of Graduation Thesis	C	9,00				9,00	PC-1, PC-4, PC-5, UC-1, UC-2, UC-3, UC-4, UC-6
2	Graduation Internship	C	6,00				6,00	PC-1, PC-2, PC-3, PC-4
	General Courses		14,00	9,00	1,00		4,00	
	Core General Courses		2,00	1,00	1,00			
1	Physical Training	C	1,00		1,00			UC-7
2	Safe Living Basics	C	1,00	1,00				UC-8
	Optional General Courses		12,00	8,00			4,00	
1	Psychology	E	4,00				4,00	UC-1, UC-5, UC-8, UC-9
2	Economics	C	4,00	4,00				UC-1, UC-2, UC-9
3	Legal Literacy	C	4,00	4,00				UC-10, UC-2, UC-3, UC-4
	Minor		20,00		10,00	10,00		
1	Minor	E	20,00		10,00	10,00		UC-1, UC-2, UC-3, UC-5, UC-6
	English		1,00				1,00	
	Examinations		1,00				1,00	
1	Independent English Exam (offered in a foreign language)	C						UC-3, UC-4, UC-5
2	Project Proposal	C	1,00				1,00	PC-5, UC-1, UC-2, UC-4, UC-5, UC-6
3	English Language Integrative Exam (offered in a foreign language)	C						UC-3, UC-4, UC-5
	Optional Courses							
1	Academic English Writing (offered in a foreign language)	O	2,00				2,00	PC-4, PC-5, UC-3, UC-4, UC-5
2	English (offered in a foreign language)	O	14,00	8,00	6,00			UC-3, UC-4, UC-5
	Data Culture		5,00			5,00		
1	Independent Programming Test. Advanced Level	C						GPC-1, GPC-2, GPC-3, GPC-4, GPC-5, PC-2, PC-3, PC-7, UC-1
2	External Examinations on Digital Skills. Entry-level	C						GPC-4
3	External Examinations on Digital Skills. Intermediate Level	C						GPC-4
4	Data Science, AI and Generative Models Independent Test. Advanced Level	C	1,00			1,00		GPC-1, GPC-2, GPC-3, GPC-4, PC-1, UC-1, UC-2

