Federal State Autonomous Educational Institution of Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba

Academy of Engineering

(name of the main educational unit (MEU) that developed the educational program of higher education)

WORKING PROGRAM OF THE DISCIPLINE

BLOCKCHAIN TECHNOLOGY

(name of discipline/module)

Recommended for the field of study/specialty:

27.04.04 CONTROL IN TECHNICAL SYSTEMS

(code and name of the field of study/specialty)

The discipline is mastered within the framework of the implementation of the main professional educational program of higher education (EP HE):

Artificial Intelligence, Machine Learning, and Space Science

(name (profile/specialization) of the educational institution of higher education)

2026

1. THE GOAL OF MASTERING THE DISCIPLINE

The "Blockchain Technology" course is part of the "Artificial Intelligence, Machine Learning, and Space Sciences" master's program, major 27.04.04 "Control in Technical Systems," and is studied in the second semester of the first year. The course is offered by the department of the partner university. It consists of four sections and nine topics and focuses on the application of cryptographic methods for data protection in blockchain systems, as well as specialized software tools and libraries for implementing cryptographic protection in blockchain projects.

The goal of this course is to develop a systemic understanding of blockchain technology, its architecture, operating principles, and potential applications for solving current information security challenges.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Blockchain Technologies" aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies developed in students while mastering the discipline (results of mastering the discipline)

Cipher	Competence	Indicators of Competency Achievement (within this discipline)
GPC-8	Able to select methods and develop control systems for complex technical objects and technological processes	GPC-8.1 Knows the basic methods used to develop control systems for complex technical objects and technological processes; GPC-8.2 Able to develop control systems for complex technical objects and technological processes; GPC-8.3 Has skills in selecting methods and developing control systems for complex technical objects and technological processes;

3. PLACE OF THE DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL EDUCATIONAL INSTITUTION

Course "Blockchain Technologies" refers to the mandatory part of block 1 “Disciplines (modules)” of the educational program of higher education.

As part of the higher education program, students also master other disciplines and/or practices that contribute to the achievement of the planned results of mastering the discipline "Blockchain Technologies".

Table 3.1. List of components of the educational program of higher education that contribute to the achievement of the planned results of mastering the discipline

Cipher	Name of competence	Previous courses/modules, practical training*	Subsequent disciplines/modules, practices*
GPC-8	Able to select methods and develop control systems for complex technical objects and technological processes	Design and Analysis of Algorithms; Python for Data Science;	Undergraduate practice / Pre-graduation practice;

* - filled in accordance with the competency matrix and the SUP EP HE

** - elective courses/practices

4. SCOPE OF THE DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total workload of the “Blockchain Technologies” course is 4 credits.

Table 4.1. Types of educational work by periods of mastering the educational program of higher education for full-time education.

Type of academic work	**TOTAL,**academic hours		**Semester(s)**
			2
Contact work, academic hours	*34*		*34*
Lectures (LC)	17		17
Laboratory work (LW)	17		17
Practical/seminar classes (SC)	0		0
Independent work of students, academic hours	*83*		*83*
Control (exam/test with assessment), academic hours	*27*		*27*
Total complexity of the discipline	**academic hours**	***144***	*144*
	credit	***4***	*4*

5. CONTENT OF THE DISCIPLINE

Table 5.1. Content of the discipline (module) by types of academic work

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
Section 1	Principles and mechanisms of operation of distributed ledger technologies	1.1	Distributed Ledger: Concept. History of the Mathematical Proof of Byzantine Fault Tolerance (BFT) and the Proof of Work Principle work (PoW).	The history of the mathematical proof of Byzantine fault tolerance (BFT) and the proof-of-work principle. The definition of a distributed ledger as a database distributed among multiple participants. The origin of the concept of Byzantine fault tolerance—the ability of a system to reach consensus in the presence of unreliable nodes. The proof-of-work principle as a defense mechanism against malicious actions.	LC, LW
		1.2	The History of Blockchain Development. Consensus Algorithms (PoW, PoS, etc.)	Consensus algorithms: PoW, PoS, and others. The history of blockchain as the technology underlying cryptocurrencies. Consensus algorithms as methods for achieving consensus among network participants. Proof-of-work (PoW): solving a computationally difficult problem to confirm a new block. Proof-of-stake (PoS): confirming a block based on the amount of cryptocurrency held.	LC, LW
Section 2	Blockchain application in management. Smart contracting. Smart contracts and the conditions for their effective implementation. Hardware and software components.	2.1	Distributed ledger as a peer-to-peer behavior regulation system. Decision-making on confirming a new block. Peer-to-peer relationships. Issues of distributed computing and distributed Registries as an information storage system. Information updating. Hash functions	Making a decision to confirm a new block. Peer-to-peer relationships. Issues of distributed computing and distributed data storage. Distributed ledgers as a tool for decentralized governance without a single central authority. The procedure for deciding whether to confirm a new block by all network participants. Peer-to-peer relationships as equal interactions between nodes without intermediaries. Issues of organizing distributed computing and distributed data storage.	LC, LW
		2.2	The use of blockchain technologies in process management, information flow, and optimization of communication networks for data storage and transmission. Smart contracts in the energy sector, smart homes, and smart cities	Optimization of communication channels for data storage and transmission. Smart contracts in energy, smart home, and smart city systems. Using blockchain to manage production processes and information flows. Optimization of communication channels and data storage systems. Smart contracts as self-executing agreements in the energy sector for automated payments. Application in smart home and smart city systems for decentralized infrastructure management.	LC, LW
		2.3	Government blockchain systems, cadastral chambers, interactive 5D maps.	Cadastral chambers, interactive 5D maps. Implementing blockchain technologies in public administration. Blockchain-powered cadastral chambers for transparent real estate accounting.	LC, LW

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
				Interactive 5D maps combining spatial data, temporal characteristics, and cost indicators.	
Section 3	Blockchain platforms, types of blockchains. Public and corporate blockchain networks. Open and closed protocols.	3.1	Blockchain platforms with closed and open source code: Ethereum, Bitcoin; Hyperledger, Corda.	Ethereum, Bitcoin, Hyperledger, Corda. Open-source platforms: Bitcoin as the first cryptocurrency, Ethereum as a smart contract platform. Closed-source platforms for enterprise use: Hyperledger, Corda.	LC, LW
		3.2	Implementing enterprise solutions on the blockchain: Smart Fuel. Open Ethereum protocols and their use for solving management problems. Masterchain as an example of a government blockchain platform.	Smart Fuel. Open Ethereum protocols for solving management problems. Masterchain as an example of a state-owned blockchain platform. Examples of corporate solutions: the Smart Fuel platform for supply chain management. Using open Ethereum protocols in task and asset management. Masterchain as a Russian state-owned blockchain platform for data exchange between financial market participants.	LC, LW
Section 4	Tokens and tokenization. Internet of Value. Cryptocurrencies. NFTs.	4.1	Tokens as a representation of value. The Internet of Things and the Internet of Values. The history of cryptocurrencies and stable tokens tied to real assets. coins).	Tokens as digital representations of value. Tokenization as the process of converting real assets into digital form. The Internet of Value as a concept for the direct exchange of value between users. Cryptocurrencies as blockchain-based digital money. Non-fungible tokens (NFTs) as unique digital objects certifying ownership of unique assets.	LC, LW
		4.2	Tokenization in intangible production, NFTs, reputation tokens. Digital diplomas	The Internet of Things and the Internet of Values. The history of cryptocurrencies and stable tokens pegged to real assets (stable coins). Tokenization in intangible production. NFTs, reputation tokens. Digital diplomas. Tokens as a universal expression of any value. The relationship between the Internet of Things and the Internet of Values for the automation of exchanges between devices. The history of cryptocurrencies and the emergence of stable tokens (stable coins) pegged to fiat currencies or real assets. Tokenization of the results of intangible production: intellectual property, reputation. Non-fungible NFT tokens for digital art and collectibles. Reputation tokens for assessing the contribution of participants. Digital diplomas and certificates on the blockchain for protection against counterfeiting.	LC, LW

* - to be completed only for FULL-TIME education: LC – lectures; LW – laboratory work; SC – practical/seminar classes.

6. LOGISTIC AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support for the discipline

Audience type	Equipment of the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	A lecture hall equipped with specialized furniture, a whiteboard (screen), and multimedia presentation equipment.	
Computer class	A computer room for conducting classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with personal computers (in the amount of ____ units), a board (screen) and technical means for multimedia presentations.	
For independent work	A classroom for independent student work (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information System.	

* - the classroom for independent work of students MUST be indicated!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

Main literature:
Further reading:
Resources of the information and telecommunications network "Internet":

1. RUDN University Electronic Library System and third-party electronic library systems to which university students have access based on concluded agreements
   - RUDN University Electronic Library System – RUDN University Electronic Library System https://mega.rudn.ru/MegaPro/Web
   - Electronic Library System "University Library Online" http://www.biblioclub.ru
   - EBS "Urayt" http://www.biblio-online.ru
   - Electronic Library System "Student Consultant" www.studentlibrary.ru
   - EBS “Knowledge” https://znanium.ru/
2. Databases and search engines
   - Sage https://journals.sagepub.com/
   - Springer Nature Link https://link.springer.com/
   - Wiley Journal Database https://onlinelibrary.wiley.com/
   - Scientometric database Lens.org https://www.lens.org

Educational and methodological materials for independent work of students in mastering a discipline/module:*

1. Lecture course on the subject "Blockchain technologies".

* - all teaching and methodological materials for independent work of students are posted in accordance with the current procedure on the discipline page in TUIS!

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