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

RELATIONAL DATABASE MANAGEMENT SYSTEM

(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 course "Relational Database Management System" is part of the Master's program "Artificial Intelligence, Machine Learning, and Space Sciences" in the 27.04.04 "Control in Technical Systems" program and is studied in the first semester of the first year. The course is offered by the department of the partner university. It consists of three sections and six topics and focuses on studying the basic methods of building databases and databases, modern database management systems, and acquiring practical skills in building databases and databases.

The purpose of mastering the discipline is to develop the student's competencies in the field of constructing databases and data banks, studying database management systems and their use in creating information systems for various technological processes and industries based on current methodological and regulatory documents and technical documentation.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the course "Relational Database Management System" 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-5	Capable of conducting patent research, determining forms and methods of legal protection and defense of rights to the results of intellectual activity, and managing rights to them to solve problems in the development of science, engineering, and technology	GPC-5.1 Knows the methods and approaches to conducting patent research, forms and methods of legal protection and defense of rights to the results of intellectual activity; GPC-5.2 Able to manage rights to the results of intellectual activity to solve problems in the field of development of science, engineering and technology; GPC-5.3 Proficient in methods and approaches to conducting patent research, knows the methods of legal protection and defense of rights to the results of intellectual activity;
GPC-6	Capable of collecting and analyzing scientific and technical information, generalizing domestic and foreign experience in the field of automation and control equipment	GPC-6.1 Knows the basic methods of collecting and analyzing scientific and technical information; GPC-6.2 Able to analyze and generalize domestic and foreign experience in the field of automation and control equipment; GPC-6.3 Has knowledge of methods for collecting and analyzing scientific and technical information, and can also generalize domestic and foreign experience in the professional field;

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

Course "Relational Database Management System" 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 "Relational Database Management System".

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-6	Capable of collecting and analyzing scientific and technical information, generalizing domestic and foreign experience in the field of automation and control equipment		Research work / Scientific research work (acquiring primary skills in scientific research work); Undergraduate practice / Pregraduation practice; Research Work; Technology Threats and Cybersecurity Systems; Inferential Statistics;
GPC-5	Capable of conducting patent research, determining forms and methods of legal protection and defense of rights to the results of intellectual activity, and managing rights to them to solve problems in the development of science, engineering, and technology		Research work / Scientific research work (acquiring primary skills in scientific research work); Undergraduate practice / Pregraduation practice; Research Work;

* - 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 course “Relational Database Management System” 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)**
			1
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	*74*		*74*
Control (exam/test with assessment), academic hours	*36*		*36*
Total complexity of the discipline	**academic hours**	***144***	*144*
	credit	***4***	*4*

5. CONTENT OF THE DISCIPLINE

*Table 5.1. Contents of the disc*modules by type of academic work

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
Section 1	Data models and database management systems	1.1	Data models. Basic data models. Hierarchical model. Basic properties of hierarchical models. Network model. Basic properties of network models. Relational model. Basic properties of relational models. Post-relational model. Basic properties of post-relational models. Object-oriented model. Basic properties of object-oriented models.	Definition of a data model. Basic data models: hierarchical, network, relational, and post-relational. Hierarchical model: basic properties, tree structure, and ancestor-descendant relationships. Network model: basic properties, graph structure, and relationship types. Relational model: basic properties, tabular representation of data, and the concept of a relationship. Post-relational model: features and extensions of the classical relational model.	LC, LW
		1.2	Relational database management system. Relational DBMS. Attributes. Schemas. Tuples. Domains. Representation forms Relationships. Relationship instances. Transforming ER diagrams to relational schemas. Relationship keys. Trivial functional dependencies. Designing relational schemas.	Definition of a relational DBMS. Key concepts: attributes (columns), relationship schemas, tuples (rows), domains (ranges of acceptable values). Forms of relationship representation. Relationship instances (specific table contents). Transformation of ER (entity-relationship) diagrams to relational schemas. Relationship keys: primary key, foreign key, candidate keys. Trivial and non-trivial dependencies.	LC, LW
Section 2	Design of databases and data banks	2.1	Database design stages. The main stages and levels of database creation and their corresponding models. Subject area. Description of the subject area. Subject area constraints. Infological model of the subject area. Datalogical model of the database. Physical model of the database. Database creation.	The main stages and levels of database creation. Models corresponding to each stage: conceptual (infological), logical (datalogical), and physical models. Subject area: definition and description. Subject area constraints. Infological model of the subject area: entities, attributes, relationships, keys.	LC, LW
		2.2	Database design. Basic design principles. Data reliability. No data redundancy. Simplicity. database structures. Selecting appropriate relationships. Using elements of appropriate types. Designing programs, transactions, triggers.	Fundamental principles of database design. Project requirements: data reliability (integrity and consistency). Absence of data redundancy (normalization). Ease of use and maintenance. Ensuring data integrity: referential integrity, domain integrity, user-defined constraints.	LC, LW
Section 3	SQL programming	3.1	SQL language. The standard language for database design. Simple SQL queries. Queries across multiple relations. Subqueries. Join expressions in SQL. Natural	The SQL language standard for designing and working with databases. Simple SQL queries (SELECT, FROM, WHERE). Queries across multiple relations: joining tables. Subqueries (nested queries). Join expressions in SQL: inner join. Natural join. Outer	LC, LW

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
			join. Outer joins. Grouping and aggregation in SQL. Updating data. Data types. Indexes. Creating and dropping indexes. Views. Creating and dropping views. View queries.	joins: left join, right join, and full join. Grouping (GROUP BY) and aggregation (COUNT, SUM, AVG, MIN, MAX) in SQL.	
		3.2	Stored Procedures and Functions. Creating Stored Procedures and Functions. Basic Properties of Stored Procedures and Functions. functions. Simple forms of expressions. Branching. LOOP loops. For loops. Using stored procedures and functions.	Creating stored procedures and functions in a DBMS. Key properties of stored procedures and functions: encapsulation, reuse, and performance enhancement. Simple expression forms. Control constructs: branching (IF-THEN-ELSE, CASE). Cycles: LOOP, FOR, and WHILE. Using stored procedures and functions to automate data operations, implement business logic, and ensure security.	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:

1. Setyawati E. et al. Relational Database Management System (RDBMS). – 2020.

2. Gillenson ML Fundamentals of database management systems. – John Wiley & Sons, 2023.

Further reading:

1. Sumathi S., Esakkirajan S. Fundamentals of relational database management systems. – Springer Science & Business Media, 2007. –T. 47.

2. Alvarez PM, Ayala ML, Cisneros SO Main Memory Management on Relational Database Systems. – Springer International Publishing, 2022.

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 Yurayt 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 "Relational Database Management System".

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

DEVELOPER:

Associate Professor		Saltykova Olga Alexandrovna
Position, DEPARTMENT	*Signature*	*Surname I.O.*

HEAD OF THE DEPARTMENT:

Position of the DEPARTMENT	*Signature*	*Surname I.O.*

HEAD OF THE EP HE:

Professor		Razumny Yuri Nikolaevich
Position, DEPARTMENT	*Signature*	*Surname I.O.*