Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Radio Engineering Systems

[RE-325] DATABASES IN RADIO TECHNICAL INFORMATION SYSTEMS

Work program of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Special and radio engineering	G5 - Electronics, electronic communications, instrument engineering,
Educational program	All
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 2nd year, spring semester
Scope of the discipline	4 credits (Lectures 16 hours, Practical classes 30 hours, Laboratory work 30 hours, Independent work 74 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course coordinator/teachers	Lectures: I. O. Tovkach, Labs: I. O. Tovkach
Course location	

Course program

1. Description of the course, its purpose, subject matter, and learning outcomes SQL is a fundamental skill in the IT world

- **Versatility:** SQL is used in almost all industries where databases are used: from

finance and marketing to software development and data analytics.

- **Standardization:** SQL is the standard language for working with relational databases, and its syntax is almost identical across different DBMSs (MySQL, PostgreSQL, Oracle, etc.).
- **Long-term relevance:** SQL has been around since the 1970s and remains one of the most popular languages for working with data.

1. **Popularity and versatility**

SQL is used in most relational databases (MySQL, PostgreSQL, SQLite, Microsoft SQL Server, Oracle). It is the standard for working with data in business, web development, and analytics.

2. **Structure and power**

SQL allows you to work efficiently with large data sets, perform complex queries, aggregate, filter, and process data.

3. **Development of cloud technologies**

Cloud databases such as Google BigQuery, Amazon RDS, and Azure SQL Database use SQL, making it even more in demand.

4. **Integration with other technologies**

SQL easily integrates with programming languages (PHP, Python, JavaScript) and frameworks (Laravel, Django, Node.js).

5. **Demand for data analytics**

SQL remains a key tool in the fields of data science, BI (business intelligence), finance, and marketing, as it helps to quickly obtain and analyze data.

6. **Ease of learning**

Compared to other programming languages, SQL has a simple syntax, making it accessible even to beginners.

The aim of the discipline:

- to provide students with theoretical knowledge and practical skills regarding the principles of database organization;

- to teach students how to model and implement information structures for radio engineering information systems;

- to develop the ability to apply modern DBMS for data processing in practical tasks of radio engineering and telecommunications;

- to develop competencies in the field of database administration and optimization.

Subject of study:

Methods and means of organizing, designing, implementing, and operating databases as part of radio engineering information systems, in particular:

- conceptual and logical data modeling;
- relational models;
- SQL language and basics of procedural extensions;
- data administration;
- integration of databases into software and hardware complexes of radio engineering systems.

Learning outcomes:

- explain the basic principles of database construction and their role in radio engineering information systems;
- model the subject area and create ER diagrams;
- use SQL to create, populate, and query databases;
- use modern DBMS (MySQL, PostgreSQL, MongoDB, etc.) to develop and maintain information systems;
- ensure data integrity, reliability, and protection;
- develop and optimize data structures to improve the efficiency of information systems;
- integrate databases into radio engineering systems software;
- independently master new tools and technologies in the field of databases.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

Prerequisites:

To successfully master the discipline, students must have knowledge and skills from the following courses:

- "Higher Mathematics" (linear algebra, mathematical logic, elements of combinatorics);
- "Computer Science and Programming" (basic algorithms, structured and object-oriented programming);

- "Fundamentals of Radio Technical Information Systems" (structure, principles of construction and functioning of RTIS).

Post-requisites:

The knowledge and skills acquired in the discipline "Databases in Radio Engineering Information Systems" are used in the further study of the following courses:

- "Signal and Information Processing Systems" (use of databases for storing and analyzing processing results);

- "Diploma Design" (development and implementation of databases in real radio engineering information systems).

3. Course content

Lecture topics:

Topic 1. Introduction to databases and basic information:

1. Data and information. Data operations; 2. History of database development; 3. Definition of database-based systems.

Topic 2. Introduction to databases and basic information:

1. Stages of database development; 2. Components of a database; 3. Database design.

Topic 3. Relational model:

1. Relational data model; 2. Relationships in a relational database. 3. Components of a relational model. 4. Codd's 12 rules.

Topic 4. Relational model:

1. Relational algebra; 2. Entity-relationship model; 3. Extended entity-relationship model.

Topic 5. Relational model:

1. Logical design; 2. Simplification of the conceptual model; 3. Methodology for converting ER diagrams into relational structures; 4. Normalization; 5. Denormalization.

Topic 6. Relational model:

1. Physical database design; 2. Indexing Topic 7. SQL:

1. Structured Query Language; 2. Installing MySQL database on a local computer; 3. DDL (Data Definition Language).

Topic 8. SQL:

1. SQL data types; 2. DDL (Data Definition Language).

Topic 9. SQL:

1. DML (Data Manipulation Language); 2. DQL (Data Query Language).

Topic 10. SQL:

1. JOIN; 2. Subquery; 3. Views; 4. Procedures; 5. Triggers; 6. MySQL API in C.

4. Learning materials and resources Main literature:

1. Date C. J. An Introduction to Database Systems. – 8th ed. – Addison-Wesley, 2003.
2. Pavlovsky, V. I. Databases and Management Tools [Electronic resource]: textbook for bachelor's degree students in the educational and professional training program for bachelors majoring in 123 "Computer Engineering" / V. I. Pavlovsky, A. V. Petrashenko; Igor Sikorsky KPI. – Electronic text data (1 file: 3 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2024. – 326 p. – Title from screen.
3. Rebecca M. Riordan. *Designing Relational Database Systems*. – Microsoft Press, 2000.
4. Dobrolyubova, M. V. Database Programming: Lecture Notes [Electronic resource]: textbook for bachelor's degree students in the educational program "Information Measurement Technologies" specialty 152 "Metrology and Information Measurement Technology" / M. V. Dobrolyubova; Igor Sikorsky KPI. – Electronic text data (1 file: 8.63 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2021. – 275 p. – Title from the screen.

Additional literature:

1. Ramakrishnan R., Gehrke J. *Database Management Systems*. – 3rd ed. – McGraw-Hill, 2014.
2. Silberschatz A., Korth H. F., Sudarshan S. *Database System Concepts*. – 7th ed. – McGraw-Hill, 2020.

Electronic resources:

- Online documentation:
  - MySQL Documentation - https://dev.mysql.com/doc/

Educational content

5. Methodology for mastering the academic discipline (educational component)

- *Lectures are conducted in accordance with the topics listed in Section 3, "Course Content."*
- *Practical classes are not provided for in the discipline's curriculum.*
- *The curriculum does not provide for seminars.*
- *Laboratory work.*

Topics of laboratory work:

Lab 1. Getting to know SQL software Lab 2. Conceptual and logical database modeling
Lab 3. Exploring the normalization of relational model relationships and applying attribute constraints to maintain data integrity

Lab 4. Learning DDL and DML commands Lab 5. Simple

SQL queries Lab 6. Complex SQL queries

Lab 7. Creating and using views Lab 8. Creating and using stored procedures Lab

9. Creating and using triggers

Lab 10. Working with MySQL in C

6. Independent work

Contents of independent work (by topic):

1. Analysis of the subject area and definition of entities in radio engineering information systems.
2. Construction of ER diagrams and logical data models.
3. Studying SQL syntax: creating, modifying, and deleting database objects.
4. Working through examples of relational link implementation (1:1, 1:M, M:M).
5. Executing queries for selecting, aggregating, sorting, and grouping data.
6. Working with indexes, views, transactions, and triggers.
7. Basics of database administration and data integrity assurance.
8. Use of databases in applied radio engineering information systems (examples from literature and laboratory assignments).

Policy and control

7. Policy of the academic discipline (educational component)

- *Students are required to attend all lectures and laboratory classes.*
- *Students are awarded incentive points for their activity in class.*
- *Students must complete homework assignments by the date set by the instructor.*
- *Penalty points will be applied to students found guilty of plagiarism.*
- *In case of failure to complete the curriculum and the presence of valid reasons for this, the student may be given an individual assignment.*

8. Types of assessment and the learning outcomes assessment rating system (LOAS)

Ongoing assessment: quizzes on the topic of the lesson, MCW, tests.

Calendar assessment: conducted twice per semester to monitor the current status of syllabus requirements.

Semester assessment: credit

Conditions for admission to semester assessment:
- *completion of all laboratory work;*

- *semester rating of more than 60 points.*

Table of correspondence between rating points and grades on the university scale

Number of points	Grade
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component) Environments and tools used: MySQL, DBeaver, Notion, ***Description of material, technical, and information support for the discipline***

Work program of the academic discipline (syllabus):
Compiled by I. O. Tovkach;
Approved by the RTS Department (Minutes No. 06/2025 dated 24.06.2025)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 25.06.2025)