

# Databases

**Prerequisites:** No prerequisites

**Learning outcomes:** Student should understand the relational model .

Student should know SQL language and how to use it to formulate queries.

Student should be able to work with modern RDBMS.

**ECTS credits** 3

**Total hours** 108

**Contact hours** 36

№	Lecture	Hours	Laboratory works		Ref
			Content	Hours	
1.	<b>Introduction to Databases and Database Systems</b>				
	General introduction on databases and database systems. Databases history. Databases versus file systems. ANSI/SPARC architecture. Functions of a Database Management System (DBMS).	2 h			[1]
2.	<b>Relational Model</b>				
	Basic notions of a relational model: domains, attributes, relations, tuples, keys (candidate keys, primary keys, foreign keys), relationships. Data integrity: entity integrity, domain integrity, referential integrity.	4 h	Database creation in a RDBMS (MySQL / MS Access / Oracle / MS SQL Server) using an existing relational schema. Defining declarative referential integrity rules. Populating the database.	2 h	[1], [2], [3]
3.	<b>Relational Algebra and Relational Calculus</b>				
	Relational Algebra of Codd. Relational Algebra operations: union, intersection and difference, selection, projection, cartesian product, division, $\theta$ -join, equijoin and natural join. Additional Relational Algebra operations of Date: rename, extend and summarize.	4 h	Querying a relational database using relational algebra.	4 h	[1], [2], [3]
	Relational calculus: tuple calculus and domain calculus.	2 h	Querying a relational database using relational calculus.	2 h	
4.	<b>Structured Query Language (SQL)</b>				
	SQL: data definition language. CREATE, ALTER and DROP statements. SQL: data control language. GRANT and REVOKE statements.	2 h	Creation/altering/dropping of database Creation/altering/dropping of tables (with definition of primary keys and references, value constraints, default values, null values). Creation/altering/dropping of constraints Creation/altering/dropping of indexes. Defining permissions.	4 h	[1], [2], [3]
	SQL: data manipulation language. SELECT statement, subqueries. INSERT, UPDATE and DELETE	4 h	Data selection, using of aggregate functions, results sorting. Using subqueries with EXISTS, ALL and ANY.	6 h	

№	Lecture	Hours	Laboratory works		Ref
			Content	Hours	
	statements.		Inserting, updating and deleting data.		
	<b>TOTAL</b>	18 h		18 h	

## References

1. (en) Date, C.J., An introduction to database systems, 7<sup>th</sup> edition. – Addison Wesley Longman, 1999. – 938 pp.  
(ru) Date, C.J., An introduction to database systems, 7<sup>th</sup> edition. : Translation from english. – M.:Williams, 2001. – 1072 pp.
2. (ru) Homonenko, A.D., Tsygankov, V.M., Maltsev, M.G., Databases: Textbook for higher education, 6<sup>th</sup> edition / ed. prof. Homonenko A.D. – SPb.: KORONA print, 2009. – 736 pp.
3. (ru) Kuznetsov, S.D., An introduction to relational databases  
<http://www.intuit.ru/department/database/rdbintro/>
4. (en) Date, C.J., SQL and Relational Theory: How to Write Accurate SQL Code. – O'Reilly Media, 2009. – 426 pp.  
(ru) Date, C.J., SQL and Relational Theory: How to Write Accurate SQL Code. – SPb.: Simbol-Plus, 2010. – 280 pp.

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