DOCTORAL (PHD) STUDIES

COURSE UNIT DESCRIPTION

Course unit title	Scientific areas	Faculty	Institute, department
Modern database systems	Informatics (N 009)	Faculty of Mathematics and Informatics	Institute of Computer Science, Department of Software Engineering

Study method	Number of credits	Study method	Number of credits
Lectures	1 (Spring sem.)	Consultations	1
Individual work	4	Seminars	1

Total credits: 7 ECTS

Summary

The course aims to acquire the knowledge of modern database management theory and its applications, develop skills in domain-specific modeling, database design, development and management, and acquire skills in working with modern database management systems.

Doctoral students who choose this course should already have the basics of database management theory and practice.

The main topics:

- Evolution of database systems: historical overview, database generations, functionality evolution, data distribution and integration, performance efficiency.
- NoSQL and NewSQL DBMS, big data. CAP theorem. BASE vs. ACID transactions. NoSQL data models, NoSQL and NewSQL vs. SQL. Big data analysis.
- XML databases. XML data retrieval. XPath and XQuery data model (XDM). Elements and applications of XPath/XQuery language. Data updating and querying. XML, JSON and web services.
- Semantic web resources and their management. RDF data model. RDF database. SPARQL Query Language.
- Object technology and database systems: object data model, object-relational databases, object databases, ODMG standard, data definition language ODL, query language OQL, data integrity maintenance in object databases.
- Data warehouse concepts and architecture. Normalized and dimensional approaches for storage of data. Online analytical processing (OLAP).
- Temporal, spatial and multimedia database systems and data processing. Active and deductive databases.
- Mobile databases: mobile devices for data storage and processing, architecture for mobile database systems. Data replication, query processing, transaction management, transaction models in mobile database systems, agent technology.
- Distributed databases: design, query processing and transaction management.

Practical exercise: choose an application (subject) area and a specific database management system, develop a data model for the subject area, implement the model by creating the necessary objects of the database, implement the main functions of data processing, prepare and present a report on the exercise.

Main literature
J.A. Hoffer, R. Venkataraman, H. Topi. *Modern Database Management*, Pearson; 13th ed., 2019.
M. Piattini, O. Diaz (eds.), *Advanced Database Technology and Design*, Artech House, 2000.
R. Ramakrishnan, J. Gehrke. *Database Management Systems*, 3rd ed., McGraw-Hill, 2003.
M.T. Öszu, P. Valduriez, *Principles of Distributed Database Systems*, 4th ed., Springer, 2020.
R. Elmasri, S.B. Navathe. *Fundamentals of Database Systems*, 7th ed., Pearson, 2016.

Lecturer(s) (name, surname)	Science degree	Main publications
Romas Baronas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Romas+Baronas
Linas Bukauskas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Linas+Bukauskas
Saulius Ragaišis	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Saulius+Ragaišis