SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Data Science / Master
1.7 Form of education	Full time
1.8 Subject code	3

2. Data about the subject

2.1 Subject name			*DataBase Systems*				
2.2 Course responsible/lecturer			Şl.Dr.Ing. Cenan Călin – Calin.Cenan@cs.utcluj.ro				
2.3 Teachers in charge of seminars/ laboratory/ project			Şl.Dr.Ing. Cenan Călin – Calin.Cenan@cs.utcluj.ro				
2.4 Year of study	1	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V - verification)			
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary						DS
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)						DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminars		Laboratory	1	Project		-
3.2 Number of hours per semester	42	of which:	Course	28	Seminars		Laboratory	14	Project		-
3.3 Individual study:											
(a) Manual, lecture material and notes, bibliography											20
(b) Supplementary study in the library, online and in the field											20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays											10
(d) Tutoring											5
(e) Exams and tests											3
(f) Other activities:											

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	58
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	Relational Databases, Java Programming Language

5. Requirements (where appropriate)

5.1. For the course	Attending min 50% of the lectures to be admitted to take the final exam
5.2. For the applications	Compulsory attendance of 100% to be admitted to take the final exam

6. Specific competence

6.1 Professional competences	1 Working with advanced mathematical methods and models, engineering and computing specific techniques and technologies.
	2 Contextual integration and exploitation of dedicated information systems.
	3 Creative pooling of multidisciplinary knowledge in the field of computers and information technology for research, design, optimization, implementation and testing of theories, algorithms and original methods specific to artificial intelligence and computer vision systems.

6.2 Cross competences	Exercising the skill of continuous self-education and demonstrating critical, innovative and research abilities.

7. Discipline objective (as results from the *key competences gained*)

7.1 General objective	The main objective of this program is to provide specific information and prepare students for working with modern database systems: both advanced relational database systems and also non-relational database systems
7.2 Specific objectives	Course it is taught using PostGreSQL together with many NoSQL database, mainly MongoDB but also Redis, Cassandra, Neo4j, Apache Spark, and Hadoop distributed database management system. To achieve the objectives, the students will learn the modern database theory and explore the emergence and benefits of NoSQL databases. Students will learn principles behind such non- relational databases systems together with basic architectures and main data models of a NoSQL database: key-value stores, document databases, column-family stores, graph databases. Students will be able to explore the research aspects of advanced databases and will be able to research, analyse and use emerging technologies such as Big Data, NoSQL, Distributed Database Systems

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
Complex Data Types 1: Semi-Structured Data (JSON, XML)	2		
Complex Data Types 2: Object Orientation; Textual Data; Spatial Data; Temporal Data	2		
DataBase Storage Structures; Indexing; Query Processing; Optimization	2		
Transaction management; Recovery; Isolation; Serializability; Consistency	2		
Concurrency Control	2		
Database-System Architectures; Parallel and Distributed Systems; Data Partitioning	2		
Data Analytics: Data Warehousing; Online Analytical Processing; Data Mining	2	Onsite/ ZOOM	
Big Data Analytics; MapReduce Paradigm and beyond	2		
Introduction to Non-Relational DataBase Systems; NoSQL databases - basic concepts	2		
Column-family stores; Key-value databases; Graph databases	2		
Document stores: MongoDB; NoSQL Operations; NoSQL database applications 1	2		
NoSQL database applications 2; MongoDB complex Queries; MongoDB Data Modelling	2		
Hadoop Distributed Architecture	2		
Cloud DataBases; DataBase as a Service	2		
Bibliography Hellerstein, Joseph, and Michael Stonebraker. Readings in Database Systems (The Red Book). 4th ed. MIT Press, 2005. ISBN: 9780262693141 Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems 2nd ed. McGraw-Hill College, 2000. ISBN: 9780072322064			
8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Redis hands-on	2	Onsite/ ZOOM	

Mongo hands-on	2		
Setting up and connecting to a Cassandra Cluster	2		
Cassandra Query Language	2		
Neo4j hands-on	2		
Data Analytics with Apache Spark	2		
Consuming Data from Data Warehouse. Design and implementation of a REST	2		

Bibliography

Hellerstein, Joseph, and Michael Stonebraker. Readings in Database Systems (The Red Book). 4th ed. MIT Press, 2005. ISBN: 9780262693141

Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems 2nd ed. McGraw-Hill College, 2000. ISBN: 9780072322064

*Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	The ability to solve domain specific problems Attendance, (inter)activity during class hours	Written Exam, activity during class hours	50%
Seminar	Tasks completion Attendance	Activity grading	50%
Laboratory			
Project			
Minimum standard of performance: Lab grade >=5, Course evaluation grade >=5			

Date of filling in:	Titulari	Titlu Prenume NUME	Semnătura
	Curs	Şl.Dr.Ing. Cenan Călin	
	Aplicații	Şl.Dr.Ing. Cenan Călin	

Date of approval in the department 20.02.2024	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the Faculty Council 22.02.2024	Dean Prof.dr.ing. Mihaela Dinsoreanu