

# SYLLABUS

## Databases 2

University year 2025-2026

### 1. Information regarding the programme

1.1. Higher education institution	Babeş-Bolyai University
1.2. Faculty	Faculty of Mathematics and Computer Science
1.3. Department	Department of Computer Science
1.4. Field of study	Computers and Information Technology
1.5. Study cycle	Bachelor
1.6. Study programme/Qualification	Information Engineering
1.7. Form of education	Full time

### 2. Information regarding the discipline

2.1. Name of the discipline	<b>Databases 2</b>			Discipline code	<b>MLE5174</b>		
2.2. Course coordinator	Lect. dr. Andor Camelia-Florina						
2.3. Seminar coordinator	Lect. dr. Andor Camelia-Florina						
2.4. Year of study	2	2.5. Semester	4	2.6. Type of evaluation	E	2.7. Discipline regime	Compulsory DD

### 3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	4	of which: 3.2 course	2	3.3 seminar/laboratory/project	1 S/ 1 LP
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar/laboratory/project	28
<b>Time allotment for individual study (ID) and self-study activities (SA)</b>					<b>hours</b>
Learning using manual, course support, bibliography, course notes (SA)					10
Additional documentation (in libraries, on electronic platforms, field documentation)					10
Preparation for seminars/labs, homework, papers, portfolios and essays					10
Tutorship					7
Evaluations					7
Other activities:					
<b>3.7. Total individual study hours</b>					<b>44</b>
<b>3.8. Total hours per semester</b>					<b>100</b>
<b>3.9. Number of ECTS credits</b>					<b>4</b>

### 4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"><li>Data Structures and Algorithms</li><li>Databases</li></ul>
4.2. competencies	Average programming skills in a high level programming language

### 5. Conditions (if necessary)

5.1. for the course	Lecture room with a video projector
5.2. for the seminar/lab activities	Lab room with a video projector, SQL Server, MongoDB

### 6.1. Specific competencies acquired <sup>1</sup>

<sup>1</sup> One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

<b>Professional/essential competencies</b>	<ul style="list-style-type: none"> <li>• Operating with the basics of mathematics, engineering and computer science</li> <li>• Design and integration of information systems using technologies and programming environments</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation</li> <li>• Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge</li> </ul>

## 6.2. Learning outcomes

<b>Knowledge</b>	<ul style="list-style-type: none"> <li>• The graduate knows and understands the basic concepts, theories and methods of Computer and Information Technology and is able to use them appropriately in professional communication.</li> <li>• The graduate knows the concepts related to software modeling and can implement functional and non-functional requirements described in specific documents for the analysis and design of software systems.</li> </ul>
<b>Skills</b>	<ul style="list-style-type: none"> <li>• The graduate is able to combine diverse information to formulate solutions and develop development ideas for new products and applications.</li> <li>• The graduate is able to present and explain the methods, algorithms, paradigms and techniques used in different branches of computer science.</li> <li>• The graduate is able to identify complex issues and examine related issues in order to design several solution and implement these solutions.</li> </ul>
<b>Responsibility and autonomy:</b>	<ul style="list-style-type: none"> <li>• The graduate has the necessary knowledge to design, analyze and manage databases.</li> <li>• The graduate has the necessary knowledge for the use of computers, the development of software programs and applications, the processing of information.</li> <li>• The graduate performs the testing and qualitative evaluation of the functional and non-functional characteristics of the information systems, based on specific criteria.</li> </ul>

## 7. Objectives of the discipline (outcome of the acquired competencies)

<b>7.1 General objective of the discipline</b>	<ul style="list-style-type: none"> <li>• To get acquainted with the fundamental concepts concerning concurrency control, database security, query optimization, distributed/NoSQL databases</li> </ul>
<b>7.2 Specific objective of the discipline</b>	<ul style="list-style-type: none"> <li>• To handle relational and NoSQL databases</li> <li>• To handle concurrently running transactions using pessimistic and optimistic isolation levels</li> <li>• To optimize queries</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1-3. Introduction. Transactions, Concurrency Control	Interactive presentation Conversation Examples Explanation	

4-5. NoSQL databases. Data models and distribution models for NoSQL databases	Interactive presentation Conversation Examples Explanation	
6. NoSQL Document Implementations: MongoDB. CRUD operations.	Interactive presentation Conversation Examples Explanation	
7-10. MQL (MongoDB Query Language). MongoDB Data Modeling	Interactive presentation Conversation Examples Explanation	
11-12. Aggregation Framework. Data Processing Pipelines in MongoDB. Cluster-level Data Replication and Sharding in MongoDB	Interactive presentation Conversation Examples Explanation	
13. Authentication and authorization mechanisms for MongoDB. MongoDB Atlas Vector Search	Interactive presentation Conversation Examples Explanation	
14. Problems	Interactive presentation Conversation Examples Explanation	
<p>Bibliography</p> <p>DATE, C.J., An Introduction to Database Systems (8th Edition), Addison-Wesley, 2003</p> <p>GARCIA-MOLINA, H., ULLMAN, J., WIDOM, J., Database Systems: The Complete Book (2nd Edition), Pearson Education, 2009</p> <p>KNUTH, D.E., Tratat de programare a calculatoarelor. Algoritmi fundamentali, Editura Tehnică, București, 1974</p> <p>KNUTH, D.E., Tratat de programare a calculatoarelor. Sortare și căutare, Editura Tehnică, București, 1976</p> <p>LEVENE, M., LOIZOU, G., A Guided Tour of Relational Databases and Beyond, Springer, 1999</p> <p>LITCHFIELD, D., ANLEY, C., HEASMAN, J., GRINDLAY, B., The Database Hacker's Handbook: Defending Database Servers, John Wiley &amp; Sons, 2005</p> <p>LIU, L., OZSU, M.T., Encyclopedia of Database Systems, Springer, 2009</p> <p>RAMAKRISHNAN, R., GEHRKE, J., Database Management Systems (3rd Edition), McGraw-Hill, 2002</p> <p>SILBERSCHATZ, A., KORTH, H., SUDARSHAN, S., Database System Concepts (7th Edition), McGraw-Hill, 2019</p> <p>ULLMAN, J., WIDOM, J., A First Course in Database Systems, <a href="http://infolab.stanford.edu/~ullman/fcdb.html">http://infolab.stanford.edu/~ullman/fcdb.html</a></p> <p>*** Azure Stream Analytics - technical documentation, <a href="https://azure.microsoft.com/en-us/services/stream-analytics/">https://azure.microsoft.com/en-us/services/stream-analytics/</a></p> <p>Pramod J. Sadalage, Martin Fowler - NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence (1st Edition), Addison-Wesley Professional, 2012</p> <p>Shannon Bradshaw, Eoin Brazil, Kristina Chodorow - MongoDB: The Definitive Guide (3rd Edition), O'Reilly Media, Inc, 2019</p>		
8.2 Seminar / laboratory	Teaching methods	Remarks
1-2. Transactions. Concurrency Control. Multiversioning	Conversation Problems Examples Explanation	
3. NoSQL Databases	Conversation Problems Examples Explanation	
4. MongoDB Schema validation. Defining and implementing collection-level validation rules	Conversation Problems Examples Explanation	
5. MongoDB PyMongo	Conversation Problems Examples Explanation	
6. Problems	Conversation Problems Examples	

	Explanation	
7. Performance Tuning in MongoDB / Problems	Conversation Problems Examples Explanation	
Bibliography Course bibliography		

### 9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course is oriented towards the problems a graduate student should solve at his / her future workplace. The acquired knowledge is considered as mandatory by software companies.
- The course is part of the academic curriculum of all major universities in Romania and abroad.
- The course structure follows the IEEE and ACM Recommendations concerning the Computer Science curriculum.

### 10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	<ul style="list-style-type: none"> <li>• to know and apply the concepts described at the course</li> <li>• to solve problems</li> </ul>	Written exam	50%
10.5 Seminar/laboratory	to be able to apply the concepts from the course and seminar to create applications that manage databases, to manage concurrent transactions	Practical exam	25%
		Lab evaluation	25%
10.6 Minimum standard of performance			
<ul style="list-style-type: none"> <li>• To pass, a student must get a grade of at least 5 (on a scale of 1 to 10) on the written exam, practical exam and lab evaluation.</li> <li>• To attend the exam, a student must have at least 5 seminar attendances and at least 6 laboratory attendances, according to the Computer Science Department's decision: <a href="https://www.cs.ubbcluj.ro/wp-content/uploads/Hotarare-CDI-29.04.2020.pdf">https://www.cs.ubbcluj.ro/wp-content/uploads/Hotarare-CDI-29.04.2020.pdf</a></li> </ul>			

### 11. Labels ODD (Sustainable Development Goals)<sup>2</sup>

*Not applicable.*

<sup>2</sup> Keep only the labels that, according to the [Procedure for applying ODD labels in the academic process](#), suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable.*”.

Date:  
12.04.2025

Signature of course coordinator



Signature of seminar coordinator



Date of approval:

Signature of the head of department

Assoc.prof.phd. Adrian STERCA