

## COURSE DESCRIPTION

### *Databases*

Academic year 2026-2027

#### 1. Programme-related data

1.1. Higher Education Institution	Babeş Bolyai University, Cluj-Napoca
1.2. Faculty	Faculty of Mathematics and Computer Science
1.3. Department	Department of Computer Science
1.4. Field	Computer Science
1.5. Level of study	Bachelor
1.6. Degree programme / Qualification	Computer Science
1.7. Form of education	Full-time

#### 2. Course-related data

2.1. Course title	<b>Databases</b>			Course code	<b>MLE5027</b>
2.2. Course coordinator	Lect. dr. Sabina Surdu				
2.3. Seminar coordinator	Lect. dr. Sabina Surdu				
2.4. Year of study	2	2.5. Semester	3	2.6. Type of assessment	Exam
2.7. Course status	Compulsory		2.8. Course type	Core subject	

#### 3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	5	of which: 3.2. course	2	3.3. seminar/ laboratory/ project	3
3.4. Total of hours in the curriculum	70	of which: 3.5. course	28	3.6. seminar/ laboratory	42
<b>Time allocation for individual study (IS) and self-taught activities (ST)</b>					<b>hours</b>
Learning from textbooks, course materials, bibliography, and notes (IS)					21
Additional research in the library, on subject-specific electronic platforms, and on-site					15
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					25
Tutoring (professional guidance)					11
Examinations					8
Other activities					
<b>3.7. Total hours of individual study (IS) and self-taught activities (ST)</b>				<b>80</b>	
<b>3.8. Total hours per semester</b>				<b>150</b>	
<b>3.9. Number of credits</b>				<b>6</b>	

#### 4. Prerequisites (where applicable)

4.1. curriculum-related	Data Structures and Algorithms
4.2 skills-related	Intermediate programming skills in a high-level programming language

#### 5. Specific conditions (where applicable)

5.1. course-related	Lecture room equipped with a video projector
5.2. seminar/laboratory-related	Computer lab with SQL Server and Visual Studio

#### 6.1. Competencies resulting from the completion of the degree programme (as referred to in the curriculum)<sup>1</sup>

<sup>1</sup> The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

Professional competencies	
Competency code	Competency
PC16	Create database diagrams
PC17	Manage databases
PC18	Design database schema
PC19	Create data models
Transversal competencies	
Competency code	Competency
TC2	Solve problems
TC3	Think analytically

## 6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)<sup>2</sup>

Learning outcomes targeted by the subject		
Competency code	Knowledge and comprehension	Specific academic skills
PC16 PC17 PC20 PC21	<i>The student/graduate describes, identifies and explains the functioning and administration of computer networks and operating systems.</i>	<i>The student/graduate designs, applies, operates and develops relational databases.</i>
PC18 PC19	<i>The student/graduate identifies, selects and justifies database design principles and models.</i>	<i>The student/graduate designs, builds and develops databases and database systems.</i>
TC2 TC3	<i>The student/graduate has the knowledge necessary to understand and solve complex problems, and to plan and organize advanced processes in various fields.</i>	<i>The graduate is able to identify complex problems and examine related issues to develop solving options and implement solutions. The graduate has the ability to apply general rules to specific problems and produce relevant solutions. The graduate is able to combine diverse information to formulate solutions and generate ideas for developing new products and applications.</i>

## 7. Subject-specific learning outcomes

Knowledge and comprehension
1. To become familiar with the fundamental concepts of databases
2. To gain a thorough understanding of the relational data model
Specific academic skills
1. To manage relational databases in SQL Server

<sup>2</sup> The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

2. To analyze data using complex SQL queries
3. To optimize SQL queries

## 8. Contents

8.1. Course	Teaching and learning methods	Remarks <sup>3</sup>
1. Introduction to Databases	Interactive presentation Discussion Examples Problem-solving Explanation	
2. The Relational Data Model	Interactive presentation Discussion Examples Problem-solving Explanation	
3. SQL Queries	Interactive presentation Discussion Examples Problem-solving Explanation	
4-5. Functional Dependencies and Normal Forms	Interactive presentation Discussion Examples Problem-solving Explanation	
6. Relational Algebra	Interactive presentation Discussion Examples Problem-solving Explanation	
7. The Physical Structure of Databases	Interactive presentation Discussion Examples Problem-solving Explanation	
8-10. Indexes, Trees, Hash Files	Interactive presentation Discussion Examples Problem-solving Explanation	
11. Evaluating Relational Algebra Operators	Interactive presentation Discussion Examples Problem-solving Explanation	
12. Conceptual Modeling	Interactive presentation Discussion Examples Problem-solving Explanation	
13. Data Streams	Interactive presentation Discussion Examples Problem-solving Explanation	

<sup>3</sup> For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

14. Problems	Interactive presentation Discussion Examples Problem-solving Explanation	
<p><b>Bibliography</b>  ABADI, D.J., CARNEY, D., CETINTEMEL, U., CHERNIACK, M., CONVEY, C., LEE, S., STONEBRAKER, M., TATBUL, N., ZDONIK, S.B., Aurora: A New Model and Architecture for Data Stream Management, The VLDB Journal, 12(2):120-139, 2003</p> <p>ARASU, A., BABCOCK, B., BABU, S., DATAR, M., ITO, K., MOTWANI, R., NISHIZAWA, I., SRIVASTAVA, U., THOMAS, D., VARMA, R., WIDOM, J., STREAM: The Stanford Stream Data Manager, IEEE Data Engineering Bulletin 26(1): 19-26, 2003</p> <p>ARASU, A., CHERNIACK, M., GALVEZ, E., MAIER, D., MASKEY, A.S., RYVKINA, E., STONEBREAKER, M., TIBBETTS, R., Linear Road: A Stream Data Management Benchmark, Proceedings of The Thirtieth International Conference on Very Large Data Bases (VLDB 2004), 480-491, 2004</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>GRIPAY, Y., LAFOREST, F., LESUEUR, F., LUMINEAU, N., PETIT, J.-M., SCUTURICI, V.-M., SEBAHI, S., SURDU, S., ColisTrack: Testbed for a Pervasive Environment Management System, Proceedings of The 15th International Conference on Extending Database Technology (EDBT 2012), 574-577, 2012</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>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>ȚÂMBULEA, L., Curs Baze de date, Facultatea de Matematică și Informatică, UBB, versiunea 2013-2014</p> <p>ȚÂMBULEA, L., Baze de date, Litografiat, Cluj-Napoca, 2003</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>		
<b>8.2. Seminar/ laboratory</b>	<b>Teaching and learning methods</b>	<b>Remarks</b>
<b>Seminar</b>		
1. SQL - Data Definition Language	Discussion Problem-solving Examples Explanation	
2. SQL - Data Manipulation Language	Discussion Problem-solving Examples Explanation	
3. Stored Procedures, Dynamic SQL, Cursors	Discussion Problem-solving Examples Explanation	
4. Functions, Views, Triggers	Discussion Problem-solving	

	Examples Explanation	
5. Indexes (I)	Discussion Problem-solving Examples Explanation	
6. Indexes (II)	Discussion Problem-solving Examples Explanation	
7. Problems	Discussion Problem-solving Examples Explanation	
<b>Laboratory</b>		
1. Database Design	Discussion Problem-solving Examples Explanation	
2. SQL Queries	Discussion Problem-solving Examples Explanation	
3. Altering the Database	Discussion Problem-solving Examples Explanation	
4. Database Testing	Discussion Problem-solving Examples Explanation	
5. Indexes	Discussion Problem-solving Examples Explanation	
Bibliography Course bibliography		

## 9. Evaluation



















Type of activity	9.1 Evaluation criteria <sup>4</sup>	9.2 Evaluation methods <sup>5</sup>	9.3 Percentage in the final grade
9.4. Course	<ul style="list-style-type: none"> <li>to understand and apply the concepts presented in the course</li> <li>to solve problems</li> </ul>	<ul style="list-style-type: none"> <li>written exam</li> </ul>	50%
9.5. Seminar/ laboratory	<ul style="list-style-type: none"> <li>to apply the concepts from the course and seminar in order to design and modify a database, analyze data using SQL queries, and optimize queries</li> </ul>	<ul style="list-style-type: none"> <li>lab evaluation</li> </ul>	25%
		<ul style="list-style-type: none"> <li>practical exam</li> </ul>	25%
9.6 Minimum standard for passing			
<ul style="list-style-type: none"> <li>To pass, a student must obtain a grade of at least 5 (on a scale from 1 to 10) in the written exam, practical exam, and lab evaluation.</li> </ul>			

<sup>4</sup> The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

<sup>5</sup> Both final evaluation methods and ongoing evaluation strategies should be established.

• To be eligible to take the exam, a student must have attended at least 12 laboratory classes and at least 5 seminar classes, according to the Decision of the Computer Science Department: <https://www.cs.ubbcluj.ro/wp-content/uploads/Hotarare-CDI-29.04.2020.pdf>.

## 10. SDG labels (Sustainable Development Goals)<sup>6</sup>

	<input type="radio"/> Sustainable Development Generic Label							
								
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
								No label applies
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Date of entry:  
22.05.2026

Signature of course coordinator

Lect. dr. Sabina Surdu

Signature of seminar coordinator

Lect. dr. Sabina Surdu

Date of approval in the department:

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Signature of the head of department

Conf. dr. Adrian Sterca

<sup>6</sup> Select a single label which, according to the [Implementation of SDG labels in the academic process](#), best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: "No label applies."