SYLLABUS

Database fundamentals

University year 2025 - 2026

1. Information regarding the programme

1.1. Higher education institution	**Babeș Bolyai University, Cluj Napoca**
1.2. Faculty	**Faculty of Mathematics and Computer Science**
1.3. Department	**Department of Computer Science**
1.4. Field of study	**Computer Science**
1.5. Study cycle	**Bachelor**
1.6. Study programme/Qualification	Artifficial Intelligence
1.7. Form of education	Full time

2. Information regarding the discipline

2.1. Name of the discipline	**Database fundamentals**					Discipline code	**MLE5260**
2.2. Course coordinator	**Lect. PhD. Emilia-Loredana Pop**						
2.3. Seminar coordinator	**Lect. PhD. Emilia-Loredana Pop**						
2.4. Year of study	**2**	2.5. Semester	**3**	2.6. Type of evaluation	**E**	2.7. Discipline regime	**Compulsory**

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

3.1. Hours per week	**5**	of which: 3.2 course	**2**	3.3 seminar/laboratory/project	**3**
3.4. Total hours in the curriculum	**70**	of which: 3.5 course	**28**	3.6 seminar/laboratory/project	**42**
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					10
Additional documentation (in libraries, on electronic platforms, field documentation)					3
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					8
Evaluations					6
Other activities:					
3.7. Total individual study hours	**55**				
3.8. Total hours per semester	**125**				
3.9. Number of ECTS credits	**5**				

4. Prerequisites (if necessary)

4.1. curriculum	Data Structures and Algorithms
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	Seminar / Lab room with SQL Server, Visual Studio and video projector

6.1. Specific competencies acquired [1]

Professional/essential competencies	• 2. analyze software specifications • 12. create data models
Transversal competencies	• 3. assume responsibility • 4. think analytically

6.2. Learning outcomes

Knowledge	• The graduate knows and understands the concepts and the techniques of knowledge representation and is able to apply them for problem solving. • The graduate has the ability to develop, design and create new applications, systems or products using best practices in the field of Computer Science. • The graduate has the ability to choose and use programming paradigms (procedural, object-oriented, functional) to create software applications appropriate to the specific field of the developed application. • The graduate has the necessary knowledge for the use of computers, the development of software programs and applications, and for the information processing. • The graduate knows and understands the mathematical foundations needed to develop intelligent algorithms and is capable of using them for algorithm implementation.
Skills	• The graduate has the necessary skills to apply various methods and tools for analysis and visualizing the results of the used Artificial Intelligence algorithms and techniques. • The graduate is able to identify complex issues and examine related issues in order to design several solutions and implement these solutions. • The graduate is able to combine diverse information to formulate solutions and develop development ideas for new products and applications. • The graduate has the ability to create automated tests of different levels of granularity to ensure the quality of developed systems.

[1] 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.

Responsibility and autonomy:	• The graduate knows, understands and uses methods for representing, analyzing and handling large volumes of data. • The graduate has the necessary knowledge to review the literature and use international databases and international digital research libraries. • The graduate has the necessary knowledge to design, analyze and manage databases. • The graduate performs the testing and qualitative evaluation of the functional and non-functional characteristics of the information systems, based on specific criteria. • The graduate has the necessary knowledge to select and use the appropriate training procedures to facilitate the process of assimilation of knowledge.

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

7.1 General objective of the discipline	• To get acquainted with the fundamental concepts concerning databases • To gain a thorough understanding of the relational data model
7.2 Specific objective of the discipline	• To manage (create, modify, remove) relational databases in SQL Server • To analyze data using complex SQL queries • To optimize SQL queries

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Databases	Interactive presentation Conversation Examples Explanation	
2. The Relational Data Model	Interactive presentation Conversation Examples Explanation	
3. SQL Queries	Interactive presentation Conversation Examples Explanation	
4. Functional Dependencies	Interactive presentation Conversation Examples Explanation	
5. Normal Forms	Interactive presentation Conversation Examples Explanation	
6. The Relational Algebra	Interactive presentation Conversation Examples Explanation	
7. The Physical Structure of Databases	Interactive presentation Conversation Examples Explanation	
8-9. Indexes. Trees. Hash files	Interactive presentation	

	Conversation Examples Explanation	
10. Evaluating the Relational Algebra Operators	Interactive presentation Conversation Examples Explanation	
11. Conceptual Modeling	Interactive presentation Conversation Examples Explanation	
12. Object Oriented Databases, Data Streams	Interactive presentation Conversation Examples Explanation	
13. Transactions, Concurrency Control	Interactive presentation Conversation Examples Explanation	
14. Problems	Interactive presentation Conversation Examples Explanation	

Bibliography

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*** Azure Stream Analytics - technical documentation, https://azure.microsoft.com/en-us/services/stream-analytics/

8.2 Seminar / laboratory	Teaching methods	Remarks
Seminar	Problems solving	
1. SQL - Data Definition Language	Conversation Problems Examples	

	Explanation	
2. SQL - Data Manipulation Language	Conversation Problems Examples Explanation	
3. Stored Procedures, Dynamic SQL, Cursors	Conversation Problems Examples Explanation	
4. Functions, Views, Triggers	Conversation Problems Examples Explanation	
5. Indexes (I)	Conversation Problems Examples Explanation	
6. Indexes (II)	Conversation Problems Examples Explanation	
7. Problems	Conversation Problems Examples Explanation	
Laboratory	Teaching programs in which real life problems can be solved	
1. Database Design	Conversation Problems Examples Explanation	
2-3. SQL Queries	Conversation Problems Examples Explanation	
4. Altering the Database	Conversation Problems Examples Explanation	
5-6. Database Testing	Conversation Problems Examples Explanation	
7. Indexes	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	• to know and apply the concepts described at the course	written exam	50%
	• to solve Databases problems		
10.5 Seminar/laboratory	• to be able to apply the concepts from the course and seminar to design / alter a database, to analyze data with SQL queries, to optimize queries	lab evaluation	25%
		practical exam	25%
10.6 Minimum standard of performance			
• 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. • To attend the exam, a student must have at least 12 laboratory attendances and at least 5 seminar attendances, according to the Computer Science Department's decision.			

11. Labels ODD (Sustainable Development Goals)[2]

Not applicable.

Date:
28.04.2025

Signature of course coordinator

Lect. PhD. Emilia-Loredana Pop

Signature of seminar coordinator

Lect. PhD. Emilia-Loredana Pop

Date of approval:
...

Signature of the head of department

Assoc.prof.phd. Adrian STERCA

[2] 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.*".