SYLLABUS

Database fundamentals

University year 2025 - 2026

1. Information regarding the programme

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 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 coor	2.2. Course coordinator			Lect. PhD. Emilia-Loredana Pop			
2.3. Seminar coordinator			Lect. PhD. Emilia-Loredana Pop				
2.4. Year of	r	2.5. Somostor	3	2.6. Type of	Г	2.7. Discipline	Compulsory
study	2	2.3. Semester	3	evaluation E	regime	Compuisory	

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	3.8. Total hours per semester 125				
3.9. Number of ECTS credits5					

4. Prerequisites (if necessary)

4.1. curriculum	Data Structures and Algorithms
4.2.	Average programming skills in a high level programming language
competencies	

5. Conditions (if necessary)

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

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

	6
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
Skills	 Intelligent algorithms and is capable of using them for algorithm implementation. 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.

	•	The graduate knows, understands and uses methods for representing, analyzing and handling large volumes of data.
lity my:	•	The graduate has the necessary knowledge to review the literature and use international
idi		databases and international digital research libraries.
ons uto	•	The graduate has the necessary knowledge to design, analyze and manage databases.
sp(•	The graduate performs the testing and qualitative evaluation of the functional and non-
Re		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.

<u> </u>	
7.1 General objective of	• To get acquainted with the fundamental concepts concerning databases
the discipline	• 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

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

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

Bibliography

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ULLMAN, J., WIDOM, J., A First Course in Database Systems, <u>http://infolab.stanford.edu/~ullman/fcdb.html</u>

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

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,	Conversation			
Cursors	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.	Eval	luation

Activity type	10.1 Evaluation criteria	10.2 Evaluation	10.3 Percentage of final	
		methods	grade	
10.4 Course	• to know and apply the concepts described at the course	written exam	50%	
	• to solve Databases problems			
	• to be able to apply	lab evaluation	25%	
10.5 Seminar/laboratory	the concepts from the course and seminar to design / alter a database, to analyze data with SQL queries, to optimize queries	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	Signature of seminar coordinator
	Lect. PhD. Emilia-Loredana Pop	Lect. PhD. Emilia-Loredana Pop

Date of approval:

Signature of the head of department

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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."*.