Department of Intelligent Transport Systems
Chair of Applied Computing

UNIVERSITY OF ZAGREB
FACULTY OF TRANSPORT AND TRAFFIC SCIENCES

UNDERGRADUATE STUDY: TRANSPORT

SEMESTER (II)

Syllabus

Academic year 2025/2026

Course: **Databases**						
Head of course: Prof. **Tonči Carić**, Ph.D.						
Co-lecturers: **Tomislav Erdelić**, Ph.D. **Martina Erdelić**, Ph.D. **Nikola Mardešić**, MSc Traff. Eng.						
Semester: **S**	Course code: **74497**	Lectures: **30**	Auditory exercises: **0**	Laboratory exercises: **45**	Seminars: **0**	ECTS credits: **6**
Group for lectures: **15 students**			Group for auditory and laboratory exercises: **15 students**			

Objective of the course:

- Teach the student the basics of working in relational databases, which includes user requirements analysis, working in a database management system, creating a relational database and the basic use of the SQL language.

Course enrolment requirements:

- There are no formal prerequisites for enrolling in this course. However, prior knowledge of basic programming concepts and logical reasoning are beneficial.

Learning outcomes:

1. Explain the basic terms used in relational databases.
2. Analyse user requirements in different transport fields to create a conceptual model.
3. Apply transformation rules to create a relational database from the conceptual model.
4. Use basic SQL commands to create a database and manipulate data in relational databases.
5. Use joins, subqueries, system functions, aggregate functions to group and retrieve data from multiple tables.
6. Examine the influence of indexing on the operations in the relational database.
7. Explain normal forms and propose changes to relational model to raise it to a higher normal form.
8. Create a simple program to connect the database and the application.

9.	Use variables, spatial data types and spatial methods when creating spatial databases.

LECTURES, EXERCISES and SEMINARS

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	▪ Description of software tools for working with databases and definition of basic terms	L	Tonči Carić		
	▪ Basics of working in a database management system and in a tool for creating a conceptual model	LE	T. Erdelić, M. Erdelić, N. Mardešić		
2.	▪ Database management systems and conceptual modelling	L	Tonči Carić		
	▪ Analysis and modelling of user requirements - examples from different transport fields: aeronautics, information and communications, logistics and intelligent transport systems	LE	T. Erdelić, M. Erdelić, N. Mardešić		
3.	▪ Relational data model and Codd's rules	L	Tonči Carić		
	▪ Analysis and modelling of user requirements - examples from different transport fields: aeronautics, information and communications, logistics and intelligent transport systems	LE	T. Erdelić, M. Erdelić, N. Mardešić		
4.	▪ Transformation rules	L	Tonči Carić		
	▪ Working in the database management system: creation of a relational model through the graphical interface - examples from different transport fields: aeronautics, information and communications, logistics and intelligent transport systems	LE	T. Erdelić, M. Erdelić, N. Mardešić		

5.	▪ Basics of relational algebra	L	Tonči Carić		
	▪ Working in the database management system: creating a relational model by writing SQL code - examples from different transport fields: aeronautics, information and communications, logistics and intelligent transport systems	LE	T. Erdelić, M. Erdelić, N. Mardešić		
6.	▪ SQL query language, basic data types, referential and domain integrity	L	Tonči Carić		
	▪ Working in the database management system: data retrieval	LE	T. Erdelić, M. Erdelić, N. Mardešić		
7.	▪ Basic data selection	L	Tonči Carić		
	▪ Working in the database management system: data manipulation	LE	T. Erdelić, M. Erdelić, N. Mardešić		
8.	▪ Data manipulation	L	Tonči Carić		
	▪ Working in the database management system: joining multiple tables and operators for working with sets	LE	T. Erdelić, M. Erdelić, N. Mardešić		
9.	▪ Retrieving data from multiple tables and operators for working with sets	L	Tonči Carić		
	▪ Working in the database management system: system functions	LE	T. Erdelić, M. Erdelić, N. Mardešić		

10.	▪ System functions and grouping	L	Tonči Carić		
	▪ Working in the database management system: grouping	LE	T. Erdelić, M. Erdelić, N. Mardešić		
11.	▪ Subqueries and variables	L	Tonči Carić		
	▪ Working in the database management system: subqueries and variables	LE	T. Erdelić, M. Erdelić, N. Mardešić		
12.	▪ Normal forms and denormalization	L	Tonči Carić		
	▪ Working in the database management system: normalization	LE	T. Erdelić, M. Erdelić, N. Mardešić		
13.	▪ Indexing	L	Tonči Carić		
	▪ Working in the database management system: indexing	LE	T. Erdelić, M. Erdelić, N. Mardešić		
14.	▪ Temporal and spatial databases	L	Tonči Carić		
	▪ Working in the database management system: spatial types, methods and time series	LE	T. Erdelić, M. Erdelić, N. Mardešić		
15.	▪ Connecting the application with the database	L	Tonči Carić		

	▪ Working in the integrated development environment: connecting the graphical interface with the database	LE	T. Erdelić, M. Erdelić, N. Mardešić		

L = Lectures; **AE** = Auditory Exercises; **LE** = Laboratory Exercises; S = Seminars

STUDENT OBLIGATIONS AND EXAMS

Conditions for obtaining signatures:
Students are obliged to attend lectures and exercises. To be able to take the final exam, students must be present at more than 60% of lectures and more than 70% of laboratory exercises. The contents of the lectures follow the chapters in the mentioned mandatory literature, and in this way it is possible to prepare the students for the lectures and to repeat the material after completing the lecture. During the semester, two preliminary exams are conducted, which have 50 points (a total of 100 points can be achieved during the semester). The exams consist of theoretical questions and/or practical tasks that need to be solved on a computer using appropriate software tools. With the achieved 60 points (minimum 60% of the maximum number of points) and more, the student is free from the written exam, and achieves a mark according to the following criteria: 60 - 69.99 points (acceptable- 2); 70 – 79.99 points (good - 3); 80 - 89.99 points (very good - 4); 90 – 100 points (excellent - 5). The oral exam is mandatory for all students.

Written Examination:

There are two ways of passing the exam:

Oral examination:

LITERATURE

a) Obligatory literature:

1. Stephens R. Begin Database Design W / WS. Jossey-Bass. 2008.
2. Karwin B. SQL Antipatterns: Avoiding the Pitfalls of Database Programming. 2017.
3. Hernandez MJ. Database Design for Mere Mortals. 25th Edition. Addison-Wesley Professional; 2020.

b) Recommended literature:

1. Elmasri R, Navathe SB. Fundamentals of Database Systems. 5th Edition, Addison-Wesley; 2006.
2. Garcia MH, Ullman J, Widom J, Database Systems: The Complete Book, 2006.
3. Ullman DJ. Database and Knowledge - base Systems. Computer Science Press; 1999.

METHODOLOGY OF THE IMPLEMENTATION OF THE COURSE PLAN

1. LECTURES

Lectures follow the material presented in authorized lectures (presentations) listed in the required literature and are mainly conducted using PowerPoint presentations and a board. Discussions on the presented topics are encouraged during the lectures.

2. AUDITORY EXERCISES

No auditory excercies.

3. LABORATORY EXERCISES

Laboratory exercises are conducted in a PC classroom. The tools used include Microsoft SQL Server, Visual Studio, and yEd Graph Editor. Exercises are carried out based on pre-prepared tasks and databases.

4. SEMINAR

No seminars.

Note: Individual and/or group viewing negative written test

5. DOCUMENTATION

Attendance is recorded for lectures, tutorial exercises, and successfully completed laboratory exercises.

6. SCORING SYSTEM

Table 1 The scoring system for the monitoring of students and explained credit values in ECTS credits

no	Segment:		Required credits to be achieved:		Remark:	ECTS credits
			Min.	Max.		
1.	Presence at the lectures		60 %	100 %		**1**
2.	Presence at the exercises (auditory and laboratory)		70 %	100 %		**1**
3.	Seminar		0	0		**0**
4.	First colloquium	= Written exam	0	20		**1**
5.	Second colloquium		0	20		**1**
6.	Oral exam		0	10		**2**
Σ	*Overall points:*		30	50	*Overall ECTS points:*	**6**

Table 2 - Explanation of the credit values in evaluations

CREDITS:	Estimate based on attendance, seminar paper and two colloquies (or written exam) - [4 ECTS]*:	The final score [6 ECTS]*:
30-35.49	Sufficient (2)	
35-39.99	Good (3)	
40-44.99	Very good (4)	
45-50	Excellent (5)	

*During the course the student is evaluated based on the sum of the internal points earned through participating in class (lectures and exercises) and grading the seminar work. The student, in order to realize the condition "courses requirements achieved", must achieve a minimum of 30 points.

Information for students (scoring system, implementation plan, learning outcomes, syllabus, literature, consulting teachers, announcement of results of examinations or colloquium, and all other information):

- **https://moodle.srce.hr/2025-2026/ (https://merlin.srce.hr)**
- **http://www.fpz.unizg.hr/isvu/2025-en/**

Student assistants: