

# MODULE DESCRIPTION FORM

Module Information			
Module Title	Database Systems Design and Development		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Lecture <input checked="" type="checkbox"/> Practical
Module Code	IT2203		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UG2	Semester of Delivery	
Administering Department	Information Technology	College	College of Science
Module Leader	Hussein Zaki Jassim Al-Mankoushi	e-mail	<a href="mailto:hussein@uowa.edu.iq">hussein@uowa.edu.iq</a>
Module Leader's Acad. Title	Asst. Lect	Module Leader's Qualification	M.Sc.
Module Tutor	Hussein Zaki Jassim Al-Mankoushi	e-mail	<a href="mailto:hussein@uowa.edu.iq">hussein@uowa.edu.iq</a>
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Scientific Committee Approval Date	2026-01-10	Version Number	1.0

Relation with other Modules			
Prerequisite module	Principles of database systems	Semester	1
Co-requisites module	Principles of database systems	Semester	1

  
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 2026 - 2025

Department Head Approval

Dean of the College Approval

## Module Aims, Learning Outcomes and Indicative Contents

<b>Module Aims</b>	<ol style="list-style-type: none"> <li>1. Provide a solid understanding of database concepts, principles, and best practices.</li> <li>2. Familiarize students with the design, implementation, and management of databases.</li> <li>3. Cover topics such as data modeling, normalization, and query optimization.</li> <li>4. Develop practical skills in using database management systems and query languages.</li> <li>5. Cultivate critical thinking and problem-solving abilities in the context of database design and administration.</li> <li>6. Prepare students to apply their knowledge in real-world scenarios.</li> <li>7. Equip students to contribute to effective database solutions in the IT industry.</li> </ol>
<b>Module Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Understand the fundamental concepts and principles of databases, including data models, schemas, and normalization.</li> <li>2. Demonstrate proficiency in designing, implementing, and managing databases using a database management system (DBMS).</li> <li>3. Apply data modeling techniques to develop logical and physical database designs that meet specified requirements.</li> <li>4. Construct and execute complex SQL queries to retrieve, update, and manipulate data stored in a database.</li> <li>5. Evaluate and optimize query performance through the use of indexing, query tuning, and other optimization techniques.</li> <li>6. Implement and enforce data integrity constraints, including entity relationships, referential integrity, and data validation rules.</li> <li>7. Employ appropriate security measures to protect data and ensure database confidentiality, integrity, and availability.</li> <li>8. Utilize backup and recovery procedures to safeguard data and restore databases in the event of failures or disasters.</li> </ol>
<b>Indicative Contents</b>	<p>Indicative content includes the following.</p> <ol style="list-style-type: none"> <li>1. Advanced Database Design: <ul style="list-style-type: none"> <li>Entity-Relationship Modeling: Extensions and enhancements to ER modeling, such as subtypes, supertypes, and specialization/generalization.</li> <li>Object-Oriented Data Modeling: Concepts of object-oriented databases and their modeling techniques, including inheritance, encapsulation, and polymorphism.</li> </ul> </li> </ol>

	<p>UML Diagrams: Utilizing Unified Modeling Language (UML) to model databases, including class diagrams, object diagrams, and sequence diagrams.</p> <p>2. Transaction Management and Concurrency Control:</p> <p>ACID Properties: Understanding the properties of atomicity, consistency, isolation, and durability in database transactions.</p> <p>Concurrency Control: Techniques for managing concurrent access to the database, including locking, timestamp-based protocols, and optimistic concurrency control.</p> <p>Recovery and Undo/Redo Logging: Mechanisms for ensuring database consistency in the face of failures, including log-based recovery and transaction rollback/commit.</p> <p>3. Query Optimization and Execution:</p> <p>Query Processing: The stages involved in processing a database query, including parsing, optimization, and execution.</p> <p>Query Optimization: Techniques for selecting the most efficient query execution plan, such as cost-based optimization, join ordering, and index selection.</p> <p>Query Execution: Strategies for executing queries, including algorithms for sorting, joining, and aggregating data.</p> <p>4. Data Storage and Indexing:</p> <p>File Structures: Storage structures for database files, such as heap files, sorted files, and hashed files.</p> <p>Indexing Techniques: Different indexing structures for efficient data retrieval, including B-trees, hash indexes, and bitmap indexes.</p> <p>Multi-Dimensional Data Structures: Introduction to data structures like R-trees and quad-trees for indexing spatial and multidimensional data.</p> <p>5. Database Security and Authorization:</p> <p>Database Security: Concepts of access control, authentication, and authorization in database systems.</p> <p>Security Models: Different security models, such as discretionary access control (DAC), mandatory access control (MAC), and role-based access control (RBAC).</p> <p>Encryption and Auditing: Techniques for encrypting data and auditing database activities for security and compliance purposes.</p>
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<b>Learning and Teaching Strategies</b>	
<b>Strategies</b>	<p>The learning and teaching strategies for studying the database subject in an IT department involve a balanced approach of theoretical understanding and practical application. Lectures, interactive discussions, and case studies provide the necessary theoretical foundation. Practical exercises, group work, and projects enable hands-on experience with database management systems. Workshops, demos, and industry examples offer real-world insights. Online resources, assessments, and feedback aid in reinforcing learning. Virtual labs and continuous learning emphasize practical skills development and staying updated with industry trends. These strategies ensure a comprehensive understanding of databases and their relevance in the IT field.</p>

### Student Workload (SWL)

<b>Structured SWL (h/sem)</b>	60	<b>Structured SWL (h/w)</b>	4
<b>Unstructured SWL (h/sem)</b>	87	<b>Unstructured SWL (h/w)</b>	6
<b>Total SWL (h/sem)</b>	147 + 3 final = 150		

### Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
<b>Formative assessment</b>	<b>Quizzes</b>	5	10% (8)	2,3,4,5,6,7	All Outcome
	<b>Onsite Assignments</b>	5	10% (5)	All Weeks	All Outcome
	<b>Lab</b>	5	10% (15)	All Weeks	All Outcome
	<b>Projects</b>	1	10% (7)	All Weeks	All Outcome
	<b>HW</b>	5	10% (5)	All Weeks	All Outcome
	<b>Report</b>	1	10% (10)	13	
<b>Summative assessment</b>	<b>Midterm Exam</b>	2hr	10% (10)	7	
	<b>Final Exam</b>	3hr	50% (50)	16	
<b>Total assessment</b>			100% (100 Marks)		

### Delivery Plan (Weekly Syllabus)

	Material Covered
<b>Week 1</b>	Introduction to databases: concepts, importance, and applications Relational database management systems (RDBMS)
<b>Week 2</b>	Overview: Introduction to Structured Query Language (SQL)
<b>Week 3</b>	Database design principles and data models

<b>Week 4</b>	Entity-Relationship (ER) modeling and ER diagrams
<b>Week 5</b>	Database constraints: primary key, foreign key
<b>Week 6</b>	Database constraints unique, and check constraints
<b>Week 7</b>	Database administration and security: user management, permissions, and access control
<b>Week 8</b>	Backup and recovery strategies for databases
<b>Week 9</b>	Indexing and query optimization techniques
<b>Week 10</b>	Transaction management and concurrency control in databases
<b>Week 11</b>	Relational model and relational calculus
<b>Week 12</b>	Relational model and relational algebra
<b>Week 13</b>	Transaction management and concurrency control in databases
<b>Week 14</b>	Transaction management and concurrency control in databases
<b>Week 15</b>	Database performance monitoring.
<b>Week 16</b>	<b>Preparatory week before the final Exam</b>

### Delivery Plan (Weekly Lab. Syllabus)

	<b>Material Covered</b>
<b>Week 1</b>	Set up a database environment using a preferred database management system
<b>Week 2</b>	Create tables in the database based on the schema design
<b>Week 3</b>	Populate the tables with sample data to simulate real-world scenarios. Include a sufficient amount of data to perform meaningful queries.
<b>Week 4</b>	SELECT Queries: Write and execute basic SELECT queries to retrieve data from single tables.
<b>Week 5</b>	Use various clauses like WHERE, ORDER BY, and LIMIT to filter, sort, and limit the results.
<b>Week 6</b>	Practice different types of join operations
<b>Week 7</b>	INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN) to combine data from multiple tables
<b>Week 8</b>	Create subqueries within SELECT statements to perform more complex queries
<b>Week 9</b>	Utilize aggregate functions (e.g., COUNT, SUM, AVG, MIN, MAX)
<b>Week 10</b>	Group data based on certain criteria using the GROUP BY clause. Apply the HAVING clause to filter the grouped data based on conditions.
<b>Week 11</b>	Practice functions like CONCAT, SUBSTRING, and LIKE
<b>Week 12</b>	Practice functions like CONCAT, SUBSTRING, and LIKE
<b>Week 13</b>	Practice writing queries with multiple levels of nested subqueries.

<b>Week 14</b>	Practice writing queries with multiple levels of nested subqueries.
<b>Week 15</b>	Implementation of an integrated database management project for each student

## Learning and Teaching Resources

	Text	Available in the Library?
<b>Required Texts</b>	Elmasri, Ramez, and Shamkant Navathe. Fundamentals of database systems. AddisonWesley Publishing Company, 2018.	Yes
<b>Recommended Texts</b>	Database design, application and development.	No
<b>Websites</b>	<a href="http://www.sqlcourse.com/">http://www.sqlcourse.com/</a>	

## Grading Scheme

Group	Grade	Mark	Marks (%)	Definition
<b>Success Group (50 - 100)</b>	<b>A</b> - Excellent	Excellent	90 - 100	Outstanding Performance
	<b>B</b> - Very Good	Very Good	80 - 89	Above average with some errors
	<b>C</b> - Good	Good	70 - 79	Sound work with notable errors
	<b>D</b> - Satisfactory	Fair / Average	60 - 69	Fair but with major shortcomings
	<b>E</b> - Sufficient	Pass / Acceptable	50 - 59	Work meets minimum criteria
<b>Fail Group (0 - 49)</b>	<b>FX</b> – Fail	Fail (Pending)	(45-49)	More work required but credit awarded
	<b>F</b> – Fail	Fail	(0-44)	Considerable amount of work required

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.