	Ministry of Higher Education and Scientific Research - Iraq Al-Nahrain University College of Science Computer Science Department	

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Database II	**Module Delivery**	
Module Type	Core	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	COMP3215		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level	6	**Semester of Delivery**	1
Administering Department	Computer Science	**College**	College of Science
Module Leader	Dr. Rasool Hisham Al-Saadi	**e-mail**	rasool.hisham@nahrainuniv.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	PhD
Module Tutor		**e-mail**	
Peer Reviewer Name	Dr. Zainab Namh Abdula	**e-mail**	zainab.namhabdula@nahrainuniv.edu.iq
Scientific Committee Approval Date	01/09/2025	**Version Number**	1.0
Lab Instructors	Assistant Professor Dr. Zainab Namh Abdula Assistant Professor Zahraa Abdulhussien Jaaz Assistant Lecturer Azhar Flaih Hassan Zahu		

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aim of this module is to develop students' understanding of advanced database concepts and techniques used in the design, implementation, and management of modern database systems. The module introduces advanced SQL operations, database design principles, normalization techniques, transaction management, concurrency control, and distributed database architectures. It also exposes students to emerging database paradigms such as NoSQL systems. Through theoretical study and practical exercises, students will acquire the skills required to design efficient database schemas, maintain data integrity, and manage multi-user database environments.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: 1. Construct advanced SQL queries using subqueries and various operators for complex data retrieval. 2. Apply Data Definition Language (DDL) commands to create, modify, and manage database structures while enforcing data integrity through constraints. 3. Design relational database schemas by identifying redundancy and resolving anomalies through normalization techniques. 4. Analyze functional dependencies and apply normalization rules up to Third Normal Form (3NF). 5. Explain and evaluate transaction management concepts including ACID properties and scheduling. 6. Analyze concurrency issues and apply locking protocols and deadlock handling techniques. 7. Explain the architecture and data management techniques used in distributed database systems. 8. Describe the role and characteristics of NoSQL databases and compare them with relational database systems. 9. Solve practical database design and query problems using appropriate database techniques.
Indicative Contents المحتويات الإرشادية	1. Advanced Data Manipulation Language 2. Data Definition Language 3. Database Design Principles 4. Data Redundancy and Anomalies 5. Functional Dependency 6. Database Normalization 7. Transaction Processing 8. Concurrency Control 9. Distributed Databases 10. NoSQL Databases

	11. Review and Practice

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The module will be delivered through a combination of lectures and practical laboratory sessions to ensure both theoretical understanding and practical skills development. • Lectures: Used to introduce theoretical concepts such as normalization, functional dependency, transaction management, and distributed databases. • Practical Laboratory Sessions: Students practice writing advanced SQL queries, implementing database constraints, creating indexes, and performing normalization exercises. • Demonstrations: The instructor demonstrates database design techniques, query optimization, and transaction management using database management systems such as MySQL or similar tools. • Problem-Solving Exercises: Students solve structured problems involving SQL queries, normalization, and transaction scheduling to reinforce theoretical concepts. • Case Studies: Realistic database scenarios are used to help students understand database design challenges and concurrency control issues. • Group Discussions: Students discuss database design solutions and analyze different approaches to solving redundancy and anomaly problems. • Independent Learning: Students are encouraged to review course materials, practice SQL queries, and explore additional database technologies such as NoSQL systems. • Revision and Review Sessions: Conducted to reinforce key concepts and prepare students for assessments.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	Continuous	All
	Assignments	1	5% (5)		All
	Projects / Lab.	1	15% (15)	Continuous	All
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)		All
	Final Exam	3hr	50% (50)		All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Course introduction and review of basic SQL. Introduction to **advanced Data Manipulation Language (DML)** and concept of **queries within queries (subqueries)**.
Week 2	**Subquery terminology**, subqueries in the **WHERE clause**, and subqueries in the **SELECT list** with examples and exercises.
Week 3	**Operators in subqueries**: IN operator review, **ANY, SOME, ALL operators**, and **EXISTS operator** with practice problems.
Week 4	**Data Definition Language (DDL)**: Creating a database, SQL data types, creating tables, introduction to **constraints and data integrity**.
Week 5	**Constraints in SQL**: NOT NULL, UNIQUE, CHECK constraints, **PRIMARY KEY and FOREIGN KEY constraints**, and introduction to **indexes** for improving query performance.
Week 6	**Database Design Concepts**: Objectives of database design, **database design tools**, their features, advantages, and disadvantages.

Week 7	**Data redundancy and anomalies**: insertion, deletion, and update anomalies; repeating groups. Introduction to **functional dependency**.
Week 8	**Midterm Exam**
Week 9	**Functional dependency inference rules (Armstrong's Axioms)**: reflexivity, augmentation, transitivity, pseudotransitivity, union, and decomposition.
Week 10	**Normalization concepts**: purpose of normalization, steps in normalization, conversion from **Unnormalized Form (UNF) to First Normal Form (1NF)**. **Normalization continued**: conversion from **1NF to 2NF** and **2NF to 3NF**, with detailed examples.
Week 11	**Normalization exercises** and complete normalization practice problems.
Week 12	**Transaction Processing**: transaction concepts, **ACID properties**, serial scheduling, anomalies due to interleaved transactions.
Week 13	**Concurrency Control**: WR, RW, and WW conflicts, **lock-based concurrency control**, locking protocols, **Strict Two-Phase Locking (2PL)**, deadlocks and recovery mechanisms.
Week 14	**Distributed Databases**: distributed DBMS architectures, client-server and peer-to-peer systems, **data replication and fragmentation**
Week 15	**NoSQL Databases**: introduction to **NoSQL databases**, and course review.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	**Review of SQL Queries:** Review SELECT statements, filtering (WHERE), sorting (ORDER BY), grouping (GROUP BY), joins, and aggregate functions.
Week 2	**Data Definition Language (DDL):** Create and modify tables using CREATE, ALTER, DROP. Define primary keys, foreign keys, constraints, and indexes.
Week 3	**SQL Subqueries:** Implement nested queries in SELECT, WHERE, and FROM clauses. Compare subqueries with joins.
Week 4	**Connecting MySQL to .NET Application:** Create a C# Windows Forms application and establish database connectivity using MySQL connector and connection strings.
Week 5	**Data Access with ADO.NET:** Use ADO.NET objects (Connection, Command, DataReader) to retrieve and display data in applications.

Week 6	**CRUD Operations:** Implement Create, Read, Update, Delete operations using parameterized SQL queries from a .NET application.
Week 7	**Data Binding with UI Controls:** Bind database data to Windows Forms controls such as TextBox, ComboBox, and ListBox.
Week 8	**Midterm Practical Exam:** Students implement a small application performing database queries and CRUD operations.
Week 9	**Working with DataTables and DataAdapters:** Use DataTable and DataAdapter to retrieve and update datasets. Display data using DataGridView.
Week 10	**Report:** Generate database reports using RDLC reports integrated with the application.
Week 11	**Transaction:** Implement database transactions to ensure atomic operations (commit and rollback).
Week 12	**Concurrency Control:** Demonstrate concurrent database access and discuss locking and isolation concepts.
Week 13	**User Authentication and Authorization:** Implement login systems, password storage, and role-based access control.
Week 14	**Integration Project & Review:** Students build a small database-driven application integrating all concepts.
Week 15	**Final Practical Exam** Comprehensive lab exam covering SQL and application development.

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management Systems", Springer, 2007.	
Recommended Texts	•Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 4th Edition, Addison Wesley, 2003. • Raghu Ramakrishnan , Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2003. • Paul Wilton, John W. Colby, "Beginning SQL", Wiley Publishing, Inc. 2005.	
Websites		

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors

	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(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.