Module (Course Syllabus) Catalogue   (2023-2024)

College/ Institute	**Khabat Technical Institute**
Department	**Information Technology**
Module Name	**Database Management Systems**
Module Code	**DMS404**
Degree	**Technical Diploma**
Semester	**Four**
Qualification	**MSc**
Scientific Title	**Lecturer**
ECTS (Credits)	**6**
Module type	**Core**
Weekly hours	**4hr**	
Weekly hours (Theory)	**(2)hr Class**	**55)Total hrs Workload**
Weekly hours (Practical)	**(4) hr Class**	**95)Total hrs Workload**
Number of Weeks	**16**
Lecturer (Theory)	**Suran Dunun Yaseen**
E-Mail & Mobile NO.	**Suran.yaseen@epu.edu.iq, 07504638017**
Lecturer (Practical)	**Mr. Srood Jalal Othman 07504623966** **Mr. Kareem Ibrahim Kareem 07501114579**
Websites	**https://moodle.epu.edu.iq/mod/resource/view.php?id=48149**

Course Book

Course Description	This course offers lecture, laboratory, and online interaction to provide a foundation in data management concepts. The database management system (DBMS) is the software that interacts with end users, applications, and the database itself to capture and analyze the data. The DBMS software additionally encompasses the core facilities provided to administer the database. The sum total of the database, the DBMS and the associated applications can be referred to as a "database system". Often the term "database" is also used to loosely refer to any of the DBMS, the database system or an application associated with the database. Computer scientists may classify database-management systems according to the database models that they support. Relational databases became dominant in the 1980s. These model data as rows and columns in a series of tables, and the vast majority use SQL for writing and querying data. In the 2000s, non-relational databases became popular, referred to as No SQL because they use different query languages.
Course objectives	The educational Objectives of this Course are: 1. To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram. 2. To make a study of SQL and relational database design. 3. To understand the internal storage structures this will help in physical DB design. 4. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure. 5. To have an introductory knowledge about the Storage and Query processing techniques

Student's obligation	The student has to prove its presence in the lecture and that by taking the percentage of attendance by me and be prepared in every lecture for a short test on the cuisse and the form of attending a report at the end of the chapter on relevant lesson and lectures taken the students subject and in the end are the students exam by exams monthly and final exam.
Required Learning Materials	The use of the following methods in the teaching process: 1. Data Show 2. Presentation 3. Course book 4. Lecturer Bound 5. Patient Magic

Evaluation

Task	Weight(Marks)	Due week	Relevant Learning outcome
Paper Review			
Homework	5%	2	5
Class Activity	2%	2	2
Report	10%	2	10
Seminar	10%	2	10
Essay	10%	1	10
Quiz	8%	4	8
Lab.	10%	1	10
Midterm Exam	5%	1	5
Final Exam	40%	1	40
Total	100	1	100

Specific learning outcome:	On successful completion of the course, the student will: 1. Identify and define the information that is needed to design a database management system for a business information problem. 2. Create conceptual and logical database designs for a business information problem. 3. Build a database management system that satisfies relational theory and provides users with business queries. 4. Understand the core terms, concepts, and tools of relational database management systems. 5. Create and maintain databases and tables..

	6. Manipulate data in a database using SQL. 7. Manage transactions and locks to ensure data concurrency and recoverability. 8. Manage users, privileges and resources 9. Start up and shut down an Oracle instance and database. 10. Study fundamentals of Recent and Emerging Database Systems in Market.
Course References:	**Key references:** 1. Principles of Distributed Database Systems by M. TAMER OZSU, Patrick Valduriez, S. Sridhar (Pearson Publication) 2. Database system concepts', 6th Edition–Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International) 3. Murach, Joel. Murach's MySQL. Mike Murach & Associates, 2012. ISBN:978-1-890774-68-4. 2. 4. MySQL is installed on servers and on individual computers in the computer lab. This software (and associated documentation) is free for academic use and may be downloaded from mysql.com 5. Silberschatz, Korth, "Data base System Concepts", 4th ed., McGraw hill, 2006. 6. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGraw Hill, 2003. 7. Peter Rob and Carlos Coronel, Database Systesm-Design, Implementation and Management (7/e), Cengage Learning, 2007. **Useful references**: 1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems (5/e), Pearson Education, 2008 2. Microsoft Office System, online training solution, Inc. KortiesFraee, 2003 Edition. 3. Computer & Internet , Dr.MuhamadBelal , Musa Abdulla Hamdan, 2009, Jordan

Course topics (Theory)	Week	Learning Outcome
Chapter 1. Database Management System – Concepts and Architectures	1	▢ Introduction and Purpose ▢ Database Architectures o Centralised o Client-Server o Server system ▢ Transaction servers ▢ Data servers ▢ Cloud based servers o Parallel o Distributed o Web based system ▢ Web architecture (2 tier , 3 tier, N-tier Architecture) ▢ Web services – SOAP
Chapter 2. Database Storage Structures	2	Introduction ▢ Database – Table space, Segment, Extent, Block, Data File ▢ Indexing, Hashing, Clusters ▢ Data Dictionary and Dictionary Views
Chapter 3. Data Models	3	▢ Introduction to various data models – Record based & Object based ▢ Cardinality Ratio & Relationships ▢ Representation of entities, attributes, relationship attributes, relationship set, Generalization, aggregation ▢ Structure of relational Database and different types of keys ▢ Codd's rules and Relational data model & relational algebra
Chapter 4. Relational Database design	4	▢ Basic System Development Life Cycle ▢ Database Design – ER to Relational ▢ Functional dependencies ▢ Normalization ▢ Normal forms based on primary keys (1NF, 2NF, 3NF, BCNF, 4NF, 5NF) ▢ Loss less joins and dependency preserving decomposition

Chapter 5. Transaction Management	5	▪ Introduction ▪ What is a Transaction? o Transaction Properties o Transaction Management with SQL o The Transaction Log ▪ Concurrency Control o Concurrency control with Locking Methods o Types of Locks o Two-Phase Locking to Ensure Serializablility o Deadlocks ▪ Concurrency Control Methods
Chapter 6. Backup and Recovery Techniques	6	▪ Introduction ▪ User Managed Backups ▪ Recovery Manager Backups - RMAN ▪ Transaction Recovery ▪ System Recovery ▪ Media Recovery
Chapter 7. Query Processing and Evaluation	7	▪ Introduction ▪ Query Interpretation ▪ Equivalence of Expressions o Selection Operation o Natural Join Operations o Projection Operations o Three-Way Join ▪ Estimation of Query-Processing Costs ▪ Estimation of Costs of Access Using Indices ▪ Structure of Query Optimizer
Chapter 8. Database Security and Authorization	8	▪ Introduction ▪ Security and Integrity Violations ▪ Managing Users ▪ Authorization-Privileges and Roles ▪ Views ▪ Integrity Constraints ▪ Database Auditing
Chapter 9. PL/SQL and RMAN SQL:	9	▪ DDL(Data Definition Language) ▪ DML(Data Manipulation Language) ▪ DRL(Data Retrieval Language) ▪ DCL(Data Control Language) ▪ TCL(Transaction Control Language)

		☐ SQL Functions and Aggregate Functions ☐ Join Operations ☐ Views
Chapter 10. a- Emerging Databases and Case Studies	10	☐ Audit Trails ☐ Plan Table PL: ☐ PL/SQL Block ☐ Control Structures ☐ Cursor, Trigger ☐ Procedure ☐ Functions RMAN Recovery Scenarios
Chapter 10. b- Emerging Databases and Case Studies	11	☐ Limitations of Conventional Databases ☐ Multimedia Database,
Chapter 10. c- Emerging Databases and Case Studies	12	☐ Temporal Databases ☐ Spatial Databases ☐ Cloud Databases ☐ Google Big Table ☐ No SQL ☐ SQLite

Practical Topics	Week	Learning Outcome
Creating and Manipulating Database objects and Applying Constraints (DDL)	1	
Manipulating Data with Database Objects (DML)	2	
Retrieving, Restricting and Sorting Data (DRL)	3	
SQL Single Row Functions	4	
SQL Multiple Row Functions (Aggregate Function)	5	
Displaying Data from Multiple Tables (Join)	6	
Using Commit and Rollback show Transaction ACID Property.	7	
Using Commit and Rollback show Transaction ACID Property.	8	
Securing data using Views and Controlling User Access	9	

(DCL)		بەڕێوەبەرایەتی دڵنیایی جۆری و متمانەبەخشین
Write a join query based on two tables and analyse the query using action plan and Audit Trails.	10	
PL/SQL Block Syntax and DML Operation through PL/SQL Block	11	
Control Structures in PL/SQL	12	
Working with Cursor	13	
Creating Procedures and Functions in PL/SQL	14	
Creating Database Triggers Database Recovery Scenarios using Recovery Manager(RMAN)	15	

1. Which SQL statement is used to extract data from a database?

(A) EXTRACT   (B) GET   (C) OPEN   (D) SELECT

Answer (D) SELECT

2. Which of the following keyword can be used to return different values?

(A) SELECT   (B) GET   (C) OPEN   (D) DISTINCT

Answer (D) DISTINCT

3. _____ operator is used to display a record if either the first condition or the second condition is true.

(A) AND   (B) OR   (C) Both (A) & (B)   (D) None of the above

Answer (B) OR

4. Which of the following DBMS provides faster response time and better performance? (A) Relational Database Management System (RDBMS)   (B) NoSQL DBMS   (C) In-Memory Database Management System (IMDBMS)   (D) None of the above

Answer (C) In-Memory Database Management System (IMDBMS)

5._____is suitable for data warehouses that have a large number of similar data items.

(A) Relational Database Management System (RDBMS)   (B) Columnar Database Management system (CDBMS)   (C) In-Memory Database Management System (IMDBMS)   (D) None of the above

Answer (B) Columnar Database Management system (CDBMS)

Which of the following is standard interactive and programming language for getting information from and updating a database.

(A) SQL (B) PHP (C) ASP (D) None of the above

 Answer (A) SQL

7. _____ keyword sorts the record in ascending order by default.

(A) ORDER BY   (B) SORT BY   (C) SORT   (D) None of the above

Answer (A) ORDER BY

8. Which of the following is an open standard Application Programming Interface (API) for accessing a database?

(A) Universal Data Access　　　(B) Open Database Connectivity　　　(C) Command Line Interface　　　(D) Open Data-Link Interface

Answer (B) Open Database Connectivity

9. Which SQL statement is used to insert new data in a database?

(A) INSERT INTO　　(B) ADD NEW　　(C) ADD RECORD　　(D) None of the above

Answer (A) INSERT INTO

10. Which method of Online Analytical Processing stores data in both a relational and a multi dimensional database.

(A) Hybrid OLAP (B) Relational OLAP (C) OLAP (D) None of the above

Answer (A) Hybrid OLAP

This set of Database Multiple Choice Questions & Answers (MCQs) focuses on "SQL Basics and SQL Data Definition".

1. Which one of the following is used to define the structure of the relation, deleting relations and relating schemas?
   a) DML(Data Manipulation Langauge)
   b) DDL(Data Definition Langauge)
   c) Query
   d) Relational Schema

Answer: b

2. Which one of the following provides the ability to query information from the database and to insert tuples into, delete tuples from, and modify tuples in the database?

   a) DML(Data Manipulation Langauge)

   b) DDL(Data Definition Langauge)

   c) Query

d) Relational Schema

Answer: a

3.

```
CREATE TABLE employee (name VARCHAR, id INTEGER)
```

What type of statement is this?

a) DML

b) DDL

c) View

d) Integrity constraint

Answer: b

4.

```
SELECT * FROM employee
```

What type of statement is this?

a) DML

b) DDL

c) View

d) Integrity constraint

Answer: a

4. The basic data type char(n) is a _____ length character string and varchar(n) is _____ length character.
   a) Fixed, equal

   b) Equal, variable

   c) Fixed, variable

   d) Variable, equal

Answer: c

5. An attribute A of datatype varchar (20) has the value "Avi". The attribute B of datatype char(20) has value "Reed". Here attribute A has ____ spaces and attribute B has ____ spaces.
   a) 3, 20

   b) 20, 4

c) 20, 20

d) 3, 4

Answer: a

6. To remove a relation from an SQL database, we use the _____ command.

a) Delete

b) Purge

c) Remove

d) Drop table

Answer: d

8.

```
DELETE FROM r;   //r - relation
```

This command performs which of the following action?

a) Remove relation

b) Clear relation entries

c) Delete fields

d) Delete rows

Answer: b

9.

```
INSERT INTO instructor VALUES (10211, 'Smith', 'Biology', 66000);
```

What type of statement is this?

a) Query

b) DML

c) Relational

d) DDL

Answer: b

11. Updates that violate _____ are disallowed.

a) Integrity constraints

b) Transaction control

c) Authorization

d) DDL constraints

Answer: a

SQL Query Language

In DBMS the SQL query language has DML, DDL, DCL, and TCL.

- DML is data manipulation language and is used for selecting, retrieving, storing, modifying, deleting, inserting and updating entries in the database. SELECT, UPDATE, INSERT, DELETE are some of the DML query statements

eg: SELECT *; this statement will select all the values and tuple from the database and display them as an output of this query

- DDL is data definition language and is useful for defining the schema and structure of the database. Commands like DROP, CREATE, ALTER, TRUNCATE, COMMENT, and RENAME are used.

eg: DROP *table name*; this statement will delete the values as well as the structure of the database.

- DCL is data control language and is useful for granting and revoking rights to and from a user. The command like GRANT and REVOKE are used.

eg: GRANT SELECT to *username*; this statement will grant or allow the user to select the data from the database.

- TCL is transaction control language and is useful for managing the transaction in the database. Commands like COMMIT, ROLLBACK, SAVEPOINT and SET TRANSACTION are used.

 Practice Questions

Q1.In SQL, which of the following is not a data Manipulation Language Commands?
a) Delete
b) Truncate
c) Update

d) Create

Answer: Truncate

Q2. In SQL, which command(s) is(are) used to change a table's storage characteristics?
a) ALTER TABLE
b) MODIFY TABLE
c) CHANGE TABLE
d) All of the Mentioned
Answer: ALTER TABLE

Q3. The transaction completes its execution is said to be
a) Committed
b) Aborted
c) Rolled back
d) Failed

Answer: Committed

Database Management System Practice Questions

Part A

Q1: What is the overall term for creating, editing, formatting, storing, retrieving a text document?   [I B P S   P. O.   2012]

A) Word processing   B) Spreadsheet design   C) Web design   D) Database management   E) Presentation generation

Q2: Which of the following constrains information about a single 'entity' in the database like a person, place, event or thing?   [S B I   P. O. 2010]

A) Query   B) Form   C) Record   D) Table   E) None of the above

Q3: A program that generally has more user-friendly interface than a D B M S is called a?   [S B I   P. O. 2010]

A) front end   B) repository   C) back end   D) form   E) None

of the above

Q4: The smallest unit of information about a record in a database is called a?   [Allahbad Bank Clerk, 2008]

A) cell   B) field   C) record   D) query   E) None of the above

Q5: A collection of conceptual tools for describing data, relationships, semantics and constraints is referred to as?   [I B P S   Clerk 2012]

A) E R mode   B) Database   C) Data model   D) D B M S   E) None of these

Find Your Answers Here

Q1: D), Q2: C), Q3: D), Q4: B), Q5: C)

Solved Questions

Q1.   The hierarchical model is also called

a. Tree structure

b. Plex Structure

c. Normalize Structure

d. Table Structure

Answer: Tree Structure

Q2. The hierarchical database model uses the hierarchic sequence that always starts at

a. the right side of the tree

b. the left side of the tree

c. the top of the tree

d. the bottom of the tree

Answer: the left side of the tree, The hierarchical database model uses the sequence that always starts from the left of the tree. Therefore the left side of the tree is the answer.

Q4.For each attribute of a relation, there is a set of permitted values, called the _____ of that attribute.

a. A. Domain

b. B. Relation

c. C. Set

d. D. Schema

Answer: Domain, The values of the attribute should be present in the domain. The domain is a set of values permitted. Therefore Domain is the answer.

Practice Questions

Q1. The tuples of the relations can be of _____ order.

a. Any

b. Same

c. Sorted

d. Constant

Answer: Any

Q2.Relational Algebra is a _____ query language that takes two relations as input and produces another relation as the output of the query.

a. Relational

b. Structural

c. Procedural

d. Fundamental

Answer: Procedural

2. Which of the following is a fundamental operation in relational algebra?

a. Set intersection

b. Natural join

c. Assignment

d. None of the mentioned

Answer: None of the mentioned

Q3. Which of the following is used to denote the selection operation in relational algebra?

a. Pi (Greek)

b. Sigma (Greek)

c. Lambda (Greek)

d. Omega (Greek)

Answer: Pi

Q4. For select operation the _____ appear in the subscript and the _____ argument appears in the parenthesis after the sigma.

a. Predicates, relation

b. Relation, Predicates

c. Operation, Predicates

d. Relation, Operation

Answer: Predicates, relation.

Practice Question

Q 1: Which of the following statements are not correct?

A) The data is the collection of information.

B) Data isolation is one of the main advantages of DBMS

C) Concurrent access and Crash recovery are one of the advantages of DBMS.

D) Both B) and C).

Ans: B) Data isolation is one of the main advantages of DBMS.

™ *__What is a DBMS__*

™ DBMS (database management system): software package designed to store and manage databases.

- – Collection of programs that manages database structure and controls access to data

- – Possible to share data among multiple applications or users

- – Makes data management more efficient and effective

- – A database management system (DBMS) is the software than controls that information

- – **Examples:**

- – Oracle

- – DB2 (IBM)

- – MS SQL Server

- – MS Access

- – Ingres

- PostgreSQL

- MySQL

What the DBMS does

™ Provides users with

- Data definition language (DDL)

- Data manipulation language (DML)

- Data control language (DCL)

™ Often these are all the same language

™ **DBMS provides**

1. Persistence

2. Concurrency

3. Integrity

4. Security

5. Data independence

6. Data Dictionary

7. Describes the database itself

™ ***Why Use a DBMS?***

1. Data independence and efficient access.

2. Data integrity and security.

3. Uniform data administration.

4. Concurrent access, recovery from crashes.

5. Replication control
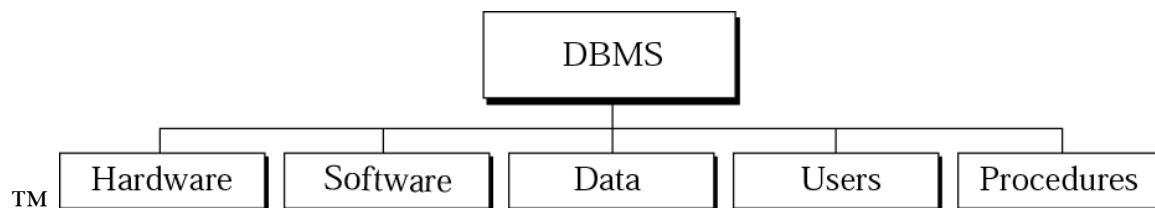
6. Reduced application development time.

™

™ **Use a DBMS when this is important**

1. persistent storage of data

2. centralized control of data

3. control of redundancy

4. control of consistency and integrity

5. multiple user support

6. sharing of data

7. data documentation

8. data independence

9. control of access and security

10. backup and recovery

™ **Do not use a DBMS when**

1. The initial investment in hardware, software, and training is too high

2. The generality a DBMS provides is not needed

3. The overhead for security, concurrency control, and recovery is too high

4. Data and applications are simple and stable

5. Real-time requirements cannot be met by it

6. Multiple user access is not needed

™ **DBMS Components**

```
                    ┌──────────┐
                    │   DBMS   │
                    └────┬─────┘
      ┌──────────┬───────┼───────┬──────────┐
┌──────────┐┌──────────┐┌──────┐┌──────┐┌────────────┐
│ Hardware ││ Software ││ Data ││Users ││ Procedures │
└──────────┘└──────────┘└──────┘└──────┘└────────────┘
```

™

There is given sql interview questions and answers that has been asked in many companies. For PL/SQL interview questions, visit our next page.

1) What is SQL?

SQL stands for the Structured Query Language. SQL is a standard query language used for maintaining the relational database and perform many different operations of data manipulation on the data. SQL initially was invented in 1970. It is a database language used for database creation, deletion, fetching rows and modifying rows, etc. sometimes it is pronounced as 'sequel.'

---

2) When SQL appeared?

It appeared in 1974. SQL is one of the often used languages for maintaining the relational database. SQL. In 1986 SQL become the standard of American National Standards Institute (ANSI) and ISO(International Organization for Standardization) in 1987.

Sample Database Design Project Outline

Database Design Project Example Outline

1. **Title Page**

   In the title page, you have to write your desired title for your project. Example:

   Sales and Inventory System

2. **Table of contents**

   In this section, You have to write the outline for your table of contents.

---

3. **System Description**

For system description, you have to write at least a minimum of 200 words.

4. **Data Dictionaries**

For Data Dictionaries, you have to write the descriptive details of each field in every table.

5. **Entity Relationship Diagram**

You have to draw an ER diagram that supports your system.

This set of Database Multiple Choice Questions & Answers (MCQs) focuses on "SQL Queries".

1.

Name
Annie
Bob
Callie
Derek

Which of these query will display the the table given above ?

a) Select employee from name

b) Select name

c) Select name from employee

d) Select employee

Answer: c

2. Here which of the following displays the unique values of the column?

```
SELECT _____ dept_name
FROM instructor;
```

      a) All
      b) b) From
      c) Distinct
      d) Name

Answer: c

3. The _____ clause allows us to select only those rows in the result relation of the _____ clause that satisfy a specified predicate.
      a) Where, from
      b) From, select
      c) Select, from
      d) From, where

Answer: a

4. The query given below will not give an error. Which one of the following has to be replaced to get the desired output?

```
SELECT ID, name, dept name, salary * 1.1
WHERE instructor;
```

      a) Salary*1.1
      b) ID
      c) Where
      d) Instructor

Answer: c

6. The _____ clause is used to list the attributes desired in the result of a query.
      a) Where

      b) Select

      c) From

      d) Distinct

Answer: b

6. This Query can be replaced by which one of the following?

```
SELECT name, course_id
FROM instructor, teaches
WHERE instructor_ID= teaches_ID;
```

      a) Select name,course_id from teaches,instructor where instructor_id=course_id;
      b) Select name, course_id from instructor natural join teaches;
      c) Select name, course_id from instructor;
      d) Select course_id from instructor join teaches;

Answer: b

7.

```sql
SELECT * FROM employee WHERE salary>10000 AND dept_id=101;
```

Which of the following fields are displayed as output?

a) Salary, dept_id

b) Employee

c) Salary

d) All the field of employee relation

Answer: d

8.

Employee_id	Name	Salary
1001	Annie	6000
1009	Ross	4500
1018	Zeith	7000

This is Employee table. Which of the following employee_id will be displayed for the given query?

```sql
SELECT * FROM employee WHERE employee_id>1009;
```

a) 1009, 1001, 1018
b) 1009, 1018
c) 1001
d) 1018

Answer: d

8. Which of the following statements contains an error?

a) Select * from emp where empid = 10003;

b) Select empid from emp where empid = 10006;

c) Select empid from emp;

d) Select empid where empid = 1009 and lastname = 'GELLER';

Answer: d

---

10. In the given query which of the keyword has to be inserted?

```
INSERT INTO employee _____   (1002,Joey,2000);
```

    a) Table
    b) Values
    c) Relation
    d) Field

Answer: b

Extra notes:
Essay Quiz
1. Let's say that you were the one hired by Sink Swim Pools in this chapter instead of Lauren. If a co-worker asked you to explain yourself after you used the phrase network of computers, what would you say to her? Elaborate so that a novice would understand completely.

2. Chaos is happening within your network. Security was discussed when you started working at your current job, but not much emphasis was placed on it at first. Now, confidential company information is appearing in competitors' planning sessions. You remember the warning you were given by your supervisor about devising a plan. Fully discuss the concept that a hierarchy of data must be established.

3. Assume that you are a member of the TEACH organization's training department. Make out a purchase order requesting that a new training lab in the TEACH training centre be joined to the network. Fully explain on your purchase order why it is necessary to join this new lab to the network and what existing components the lab will rely upon once it is connected.

4. Explain the concept of a network client and, after analysing the TEACH organizational chart once again, determine the maximum number of network clients you would expect to have on that company's entire network.

External Evaluator