Course Objectives

At the end of the course the student will be able to:

1. Differentiate database systems from traditional file systems by enumerating the features provided by database systems..
2. Design entity-relationship diagrams to represent simple database applications
3. Construct relational algebraic expressions for queries using the concepts of relational database theory
4. Formulate using SQL, solutions to a broad range of query and data update problems
5. Apply Normalization to improve database design
6. Identify the basic issues of transaction processing and concurrency control.

Syllabus

Unit 1

Introduction: Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client-server architectures, Classification of Database Management systems, Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets, Roles and Structural Constraints Weak Entity Types..

Unit 2

Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Concepts, Relational Model Constraints and Relational Database Schema Update Operations, Transactions and Dealing with Constraint violations, Unary Relational operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra Relational Database Design Using ER- to-Relational Mapping.

Unit 3

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic structure of SQL Queries, Additional Basic Operations, Null values, Aggregate Functions, nested Sub queries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization. Database programming issues and techniques, Embedded SQL.

Unit 4

Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of 2nd and 3rd Normal Forms, Boyce Codd Normal Forms, Multivalued Dependencies and IV Normal Forms, Join Dependencies and V Normal Forms, Inference Rules, Equivalence and Minimal Cover, Properties of Relational Decomposition, Algorithms for relational database schema design.

Unit 5

Transaction Management: Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels. Concurrency Control: Lock-Based Protocols, Deadlock Handling. Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm

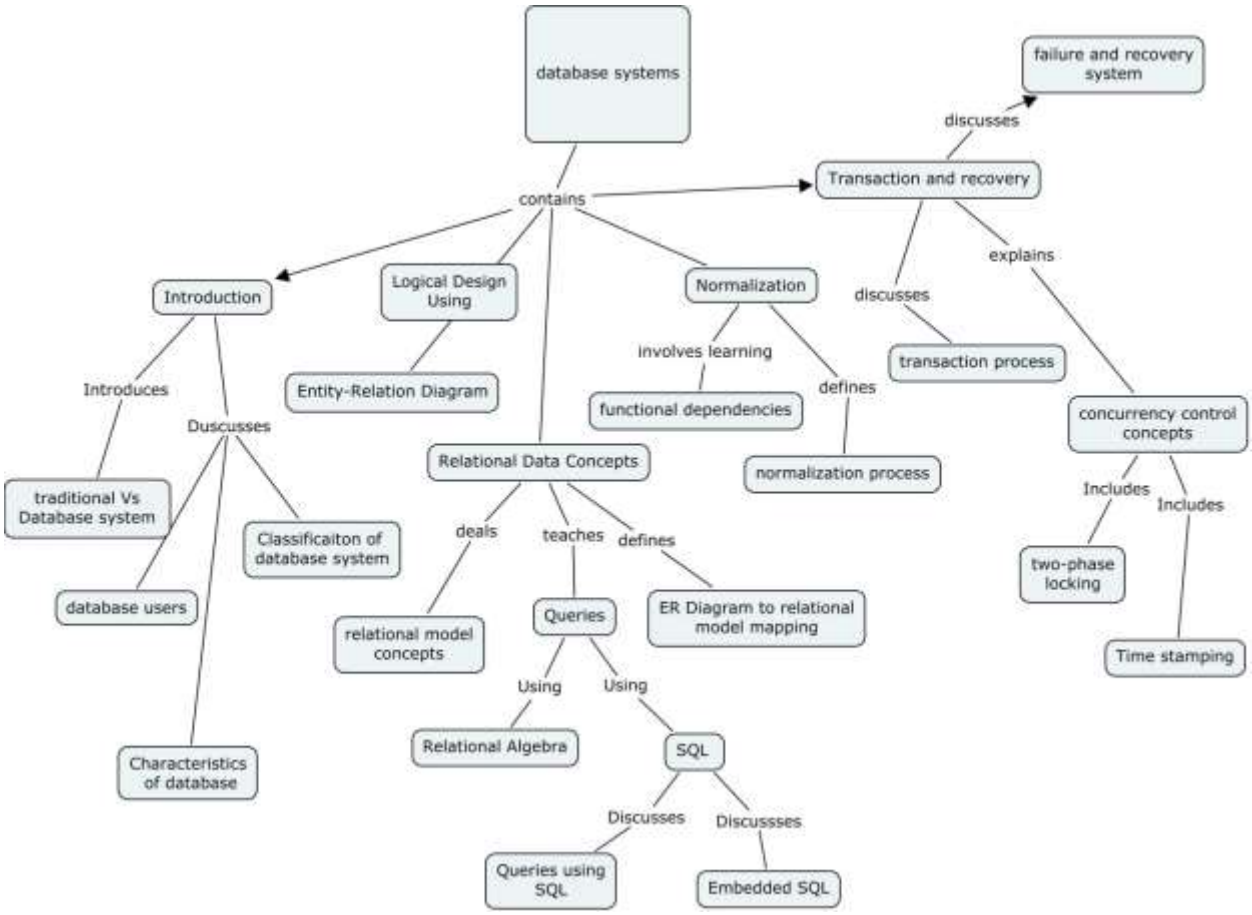
Text Book:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2011.
2. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Tata McGraw Hill, 2011

Reference Books:

1. .C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson education, 2009

Concept map



Course Contents and Lecture Schedule

Lesson No	Topic	Duration
	Unit 1	**11Hrs**
1.	Introduction: Characteristics of Database approach	1 Hour
2.	Advantages of using DBMS approach	1 Hour
3.	Data models, schemas and instances	1 Hour
4.	Three-schema architecture and Data Independence	1 Hour
5.	Database Languages and Interfaces	1 Hour
6.	Database system environment, Centralized and Client-Server Architectures for DBMSs	1 Hour

7.	Classification of Database Management systems	1 Hour
8.	Entity types, Entity sets, Attributes and keys	1 Hour
9.	Relationship types, sets, roles and structural constraints	1 Hour
10.	Weak entity types, Naming conventions and design issues.	1 Hour
11.	ER Diagrams.	1 Hour
	Unit 2	**11 Hours**
12.	Relational Model Concepts	1 Hour
13.	Relational Model constraints and Relational Database Schemas	1 Hour
14.	Update Operations, Transactions and Dealing with Constraint Violations.	1 Hour
15.	Unary Relational Operations: SELECT and PROJECT	1 Hour
16.	Relational Algebra Operations from Set Theory	1 Hour
17.	Binary Relational Operations: JOIN and DIVISION	1 Hour
18.	Additional Relational Operations, Generalized projection	1 Hour
19.	Aggregate functions and grouping	1 Hour
20.	Recursive Closure Operations	1 Hour
21.	OUTER JOIN, OUTER UNION operations	1 Hour
22.	Relational Database Design Using ER- to-Relational Mapping	1 Hour
	Unit 3	**11 Hours**
23.	SQL Data Definition and Data Types	1 Hour
24.	Specifying constraints in SQL	1 Hour
25.	Schema change statements in SQL	1 Hour
26.	Basic queries in SQL	1 Hour
27.	More complex SQL Queries	1 Hour
28.	Insert, Delete and Update statements in SQL	1 Hour
29.	Specifying constraints as Assertion and Trigger	1 Hour
30.	Views (Virtual Tables) in SQL	1 Hour
31.	Additional features of SQL	1 Hour

32.	Database programming issues and techniques	1 Hour
33.	Embedded SQL.	1 Hour
	Unit 4	**11 Hours**
34.	Informal Design Guidelines for Relation Schemas	1 Hour
35.	Functional Dependencies, Inference rules for functional dependencies	1 Hour
36.	Equivalence of sets of functional dependencies, Minimal sets of functional dependencies	1 Hour
37.	Normal forms based on primary keys	1 Hour
38.	First Normal Form, Second Normal Form, Third Normal Form	1 Hour
39.	General definitions of Second and Third Normal Forms, Boyce-codd Normal Form	1 Hour
40.	Dependency Preservation property of a Decomposition, Non additive Join property of a Decomposition	1 Hour
41.	Algorithms for relational database schema design	1 Hour
42.	Multivalued dependencies and Fourth Normal Form	1 Hour
43.	Join dependencies and Fifth Normal Form	1 Hour
44.	Inclusion Dependencies, Other dependencies and Normal Forms	1 Hour
	Unit 5	**12Hrs**
45.	Introduction to Transaction Processing, Transaction Concept,	1 Hour
46.	Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability	1 Hour
47.	Characterizing Schedules Based on Serializability, Transaction Support in SQL	1 Hour
48.	Two-Phase Locking Techniques for Concurrency Control	1 Hour
49.	Concurrency Control Based on Timestamp Ordering	1 Hour
50.	Multiversion Concurrency Control Techniques	1 Hour
51.	Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking	1 Hour
52.	Using Locks for Concurrency Control in Indexes, Other Concurrency Control Issues.	1 Hour
53.	Recovery Concepts, Recovery Techniques Based on Deferred Update	1 Hour

54.	Recovery Techniques Based on Immediate Update, Shadow Paging	1 Hour
55.	The ARIES Recovery Algorithm	1 Hour
56.	Recovery in Multidatabase Systems, Database Backup and Recovery from Catastrophic Failures	1 Hour

Course Outcomes

At the end of the course students should be able to:

CO1: Differentiate database systems from traditional file systems by enumerating the features provided by database systems..
CO2: Design entity-relationship diagrams to represent simple database applications
CO3: Construct relational algebraic expressions for queries using the concepts of relational database theory
CO4: Formulate using SQL, solutions to a broad range of query and data update problems
CO5: Apply Normalization to improve database design
CO6: Identify the basic issues of transaction processing and concurrency control