

# DATABASE MANAGEMENT SYSTEMS

- Pre-requisites
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- Outcomes
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- Text and Reference Books
- e-Resources

# DATABASE MANAGEMENT SYSTEMS

## Pre-requisites:

- Discrete mathematics of computer science
- Programming and Data Structures

# DATABASE MANAGEMENT SYSTEMS

## Course Objectives:

1. Familiarize students with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. Understand about data storage techniques and indexing.
3. Impart knowledge in transaction management, concurrency control techniques and recovery procedures.

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## Course Outcomes:

*Upon completion of this course, students will be able to:*

1. Design database schema for an application using RDBMS concepts.
2. Write SQL queries for tasks of various complexities.
3. Build applications using database system as backend.
4. Understand internal working of a DBMS including data storage, indexing, query processing, transaction processing, concurrency control and recovery mechanisms.
5. Analyze non-relational and parallel/distributed data management systems with a focus on scalability.

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## SYLLABUS:

### UNIT I

#### **Introduction:**

- Motivation
- Introduction to Data Models (Relational, Semi structured, ER)

#### **Relational Databases:**

- Relational Data Model
- Relational Algebra
- Relational Calculus

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## SYLLABUS:

### UNIT II

#### **SQL + Interaction with Database:**

- SQL Data Types
- Basic Structure of SQL Queries
- Modification of the Database
- Set Operations
- Aggregate Functions
- Data-Definition Language

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SYLLABUS:

## UNIT II

### **SQL + Interaction with Database:** cont'd

- Integrity Constraints
- Null Values
- Views
- Join Expression
- Index Definition in SQL

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## SYLLABUS:

### UNIT II

#### **SQL + Interaction with Database:** cont'd

- Simple Queries (select/project/join/ aggregate queries)
- Complex queries (With Clause, Nested Subqueries, Views)
- Programming in a standard language and interfacing with a DB backend



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SYLLABUS:

## UNIT III

### Big Data:

- Key-value Stores and Semi structured Data
- using JSON and MongoDB, or other combinations

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SYLLABUS:

## UNIT III

### Database Design:

- Introduction to ER model
- Mapping from ER to relational model
- Functional Dependencies
- Normalization

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## SYLLABUS:

### UNIT IV

#### **Physical Design:**

- Overview of Physical Storage (Hard Disks, Flash/SSD/RAM)
- Sequential vs random I/O
- Reliability via RAID
- Storage Organization (Records, Pages and Files)
- Database Buffers
- Database Metadata
- Indexing
- B+ Trees

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SYLLABUS:

## UNIT V

### Query Processing and Optimization:

- Query Processing
- External sort
- Joins using nested loops
- indexed nested loops

SYLLABUS:

## UNIT V

### **Overview of Query Optimization:**

- Equivalent expressions and
- concept of cost based optimization

SYLLABUS:

## UNIT V

### **Transaction Processing:**

- Concept of transactions and schedules
- ACID properties
- Conflict-serializability

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SYLLABUS:

## UNIT V

### Concurrency control:

- Locks
- 2PL
- Strict 2PL
- optional: isolation levels, Recovery using undo and redo logs

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## SYLLABUS:

### Text Books and References:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill. Indian Edition, 2021 (<https://www.db-book.com/>)
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Pubs, 2017
3. Lemahieu, Broucke and Baesens, "Principles of Database Management", Cambridge University Press, 2018 (Slides: <https://www.pdbmbook.com/lecturers/slides/access>)
4. RP Mahapatra, "Database Management Systems", Khanna Publishing House, 2020.
5. Krishnan, "Database Management Systems", McGraw Hill.



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## SYLLABUS:

### Suggested Reading:

1. MySQL Explained: Your Step By Step Guide To Database Design
2. Pro SQL Server 2008 Relational Database Design and Implementation (Expert's Voice in SQL Server) 1st Edition

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## SYLLABUS:

### **NPTEL/SWAYAM Course:**

1. <https://nptel.ac.in/courses/106105175>
2. <https://www.oracle.com/news/connect/json-database-semistructured-sql.html>

## Course Objectives:

1. Become familiar with the concepts of structured query language.
2. Understand about programming language / structured query language (PL/SQL).
3. Become familiar with generation of form and open database connectivity.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

## Course Outcomes:

Upon completion of this course, students will be able to:

1. Outline the built-in functions of SQL and apply these functions to write simple and complex queries using SQL operators.
2. Demonstrate Queries to Retrieve and Change Data using Select, Insert, Delete and Update. Construct Queries using Group By, Order By and Having Clauses.
3. Demonstrate Commit, Rollback, Save point commands, SQL Plus Reports and formulate the Queries for Creating, Dropping and Altering Tables, Views, constraints.
4. Develop queries using Joins, Sub-Queries and Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.
5. Demonstrate the usage of data types, Bind and Substitution Variables, Anchored, Declarations, Assignment Operation and PL/SQL code using Control Structures.
6. Develop PL/SQL code using Cursors, Exception, Composite Data Types and Procedures, Functions and Packages.

## List of experiments/programs: SQL

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select Insert, Delete and Update
4. Queries using Group By, Order By and Having Clauses
5. Queries on Controlling Data: Commit, Rollback and Save point.

## List of experiments/programs: SQL

6. Queries to Build Report in SQL \*PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints
8. Queries on Joins and Correlated Sub-Queries
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update
10. Creating Password and Security features
11. Querying in NoSql

## List of experiments/programs: PL/SQL

1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

## Text Books / Suggested Reading:

1. "Oracle: The complete Reference", by Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.