

Chapter 1 : Introduction to Database Concepts
1-1 to 1-14

Syllabus : Database, DBMS Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture

1.1 Introduction to Database..... 1-1

1.2 Overview of DBMS 1-2

1.3 Advantages of DBMS (File System v/s Database System) 1-4

1.4 Levels of Abstraction..... 1-5

1.5 Data Independence 1-7

1.5.1 Types 1-7

1.6 DBMS Architecture..... 1-8

1.6.1 Query Processor Components..... 1-8

1.6.2 Storage Manager / Storage Management 1-10

1.6.3 Transaction Management..... 1-10

1.7 Working of DBMS..... 1-10

1.8 Database Users 1-11

1.9 Database Administrator (DBA) 1-12

1.9.1 Roles of DBA..... 1-12

1.9.2 Responsibilities of DBA 1-13

Chapter 2 : Data Models 2-1 to 2-13

Syllabus : Client/Server Architecture, Object Based Logical Model, Record Based Logical Model (relational, hierarchical, network).

2.1 Client Server Architecture / Multiuser DBMS Architectures 2-1

2.1.1 Client-Server Architecture Types 2-1

2.1.1(A) Single Tier Architecture / Centralized Database Architecture..... 2-1

2.1.1(B) Two Tier Architecture..... 2-2

2.1.1(C) Three Tier Architecture..... 2-2

2.1.1(D) N Tier Architecture..... 2-4

2.1.1(E) Goals of Client-Server Architecture 2-5

2.2 Object Based Logical Model 2-5

2.3 Record based Logical Model 2-6

2.3.1 Relational Model..... 2-6

2.3.2 Hierarchical Model 2-8

2.3.3 Network Database Model..... 2-10

2.4 Comparison of All Data Models 2-12

Chapter 3 : Entity Relationship Model 3-1 to 3-25

Syllabus : Entities, attributes, entity sets, relations, relationship sets, Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization, Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER).

3.1 Entity-Relationship (ER) Model 3-1

3.2 Entities..... 3-1

3.3 Attributes 3-3

3.3.1 Types Of Attribute 3-3

3.3.2 Types of Keys 3-6

3.4 Relations 3-7

3.5 Additional Constraints 3-8

3.6 Extended Entity-Relationship (ER) Model 3-11

3.6.1 Specialization 3-12

3.6.2 Generalization..... 3-12

3.6.3 Attribute inheritance..... 3-13

3.6.4 Constraints and Characteristics of Specialization and Generalization..... 3-13

3.7 Aggregation..... 3-17

3.8 Conceptual Design using ER 3-17

Chapter 4 : ER to Table 4-1 to 4-10

Syllabus : Entity to Table, Relationship to tables with and without key constraints.

4.1 Entities to Tables..... 4-1

4.2 Attributes to Columns of Table..... 4-2

4.3 Relationships to Tables with and without constraints..... 4-4

4.4 Mapping Inheritance constraints 4-6

4.5 Solved Examples..... 4-7

Chapter 5 : Data Definition Language 5-1 to 5-9

Syllabus : Creating Databases, Using Databases, datatypes, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables.

5.1 Overview of SQL 5-1

5.1.1 Role of SQL..... 5-1

5.2 Data Definition Language (DDL) 5-2

5.3 CREATE Statement..... 5-3

5.4 Create Table with Integrity Constraints..... 5-4

5.4.1 Domain Integrity Constraint..... 5-4

5.4.2 Entity Integrity Constraint..... 5-5

5.4.3 Referential Integrity Constraint in SQL..... 5-6

5.5 Alter Table..... 5-7

5.6 Renaming Table..... 5-8

5.7 Truncating Table..... 5-8

5.8 Dropping Tables..... 5-8

Chapter 6 : Data Manipulation Language 6-1 to 6-25

Syllabus : Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, between clause, limit, aggregate functions (count, min, max, avg, sum), group by clause, having clause

6.1 Viewing the structure of a table 6-1

6.2 Data Manipulation Language (DML)..... 6-2

6.3 SELECT Statement..... 6-4

6.3.1 SELECT Clause - To Select all Columns..... 6-4

6.3.2 SELECT Clause - To Select Specific Columns..... 6-5

6.3.3 SELECT Clause – To Select Unique Records 6-6

6.4 Ordering of Types..... 6-7

6.4.1 Ordering Query Results - ORDER BY Clause 6-7

6.5 SQL Operations 6-8

6.5.1 Filtering Query Results - WHERE Operator 6-8

6.5.1(A) Row Selection – WHERE Clause
(Conditional select)..... 6-9

6.5.2 Arithmetic Operators6-10

6.5.3 Comparison Operators6-10

6.5.4 Logical Operators (AND, OR, NOT)6-11

6.5.5 Range Searching Operators (BETWEEN)6-12

6.5.6 Pattern Matching Operation – LIKE Operator.....6-12

6.6 Limit Clause – Restricting Rows in Result.....6-15

6.7 Aggregate Functions.....6-17

6.7.1 Types of Aggregate Functions.....6-18

6.7.2 Summary of Aggregate Functions6-20

6.8 GROUP BY Clause - Grouping Query Results ...6-21

**6.9 HAVING Clause – Filtering grouped
Query Results.....6-22**

6.9.1 Apply Conditions with GROUP BY.....6-22

6.10 GROUP BY and Aggregate Function6-24

Chapter 7 : Relational Data Model 7-1 to 7-9

Syllabus : Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint, Check constraint.

7.1 Relational Data Model 7-1

7.1.1 Relation / Relational Table..... 7-2

7.1.2 Attributes / Fields..... 7-2

7.1.3 Tuple / Records..... 7-2

7.1.4 Domain 7-2

7.2 Relational Constraints 7-3

7.2.1 Domain Integrity Constraint..... 7-3

7.2.2 Entity Integrity Constraints 7-4

7.2.2(A) Unique Constraint..... 7-4

7.2.2(B) Primary Key Constraint..... 7-4

7.2.3 Referential Integrity and Foreign Key..... 7-5

7.3 Key Concept..... 7-7

7.3.1 Types of Keys..... 7-7

Chapter 8 : Relational Algebra 8-1 to 8-16

Syllabus : Operations (selection, projection, set operations union, intersection, difference, cross product, Joins – conditional, equi join and natural joins, division)

8.1 Relational Algebra..... 8-1

8.2 Selection Operation (σ) 8-1

8.3 Projection Operation (π)..... 8-3

8.4 Rename Operation (ρ) 8-4

8.5 SET Operation 8-4

8.5.1 Union Operator..... 8-5

8.5.2 Intersect Operator 8-6

8.5.3 Difference Operator 8-7

8.6 Cross Product 8-9

8.7 Joins Conditional (\bowtie_{θ})..... 8-10

8.8 Relational Division Operator 8-13

8.9 Operator Precedence 8-14

8.10 Relational Algebra Queries - Solved Examples..... 8-14

Chapter 9 : SQL Functions 9-1 to 9-8

Syllabus : String Functions (concat, instr, left, right, mid, length, lcase/lower, ucase/upper, replace, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod, pow, sqrt, round, truncate) Date Functions (adddate, datediff, day, month, year, hour, min, sec, now, reverse).

9.1 Inbuilt Functions in MySQL..... 9-1

9.2 String Functions 9-2

9.2.1 Case Manipulation Functions 9-2

9.2.2 Character Manipulation Functions 9-3

9.3 Arithmetic Functions..... 9-4

9.4 Date Time Functions..... 9-6

9.5 Conversion functions..... 9-7

9.6 Special Date Formats..... 9-8

Chapter 10 : SQL Joining Tables 10-1 to 10-15

Syllabus : Inner join, outer join (left outer, right outer, full outer).

10.1 MySQL SET Operations 10-1

10.1.1 UNION 10-1

10.1.2 INTERSECT 10-2

10.1.3 EXCEPT..... 10-3

10.1.4 Nesting SET Operations 10-3

10.2 SQL Joining Tables..... 10-4

10.2.1 Cartesian Product / Cross Join..... 10-4

10.2.2 Inner Join..... 10-5

10.2.3 Outer Join 10-8

10.2.3(A) Left Outer Join..... 10-9

10.2.3(B) Right Outer Join..... 10-10

10.2.3(C) Full Outer Join..... 10-10

10.3 Solved Examples 10-11

Chapter 11 : Subqueries 11-1 to 11-12

Syllabus : Subqueries with IN, EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated subqueries.

11.1 Concept of Sub Queries..... 11-1

11.1.1 Independent Subquery 11-1

11.1.2 Subquery Restrictions..... 11-2

11.1.3 Multiple Row Subquery\ Nested Subqueries 11-3

11.2 Set Membership 11-3

11.2.1 Subquery with IN 11-3

11.2.2 Subquery with ANY 11-4

11.2.3 Subquery with ALL..... 11-5

11.2.4 Subquery with EXISTS Clause 11-5

11.2.5 Subquery with NOT EXISTS clause 11-6

11.3 Correlated Sub Queries 11-6

11.4 Solved Examples 11-9

Chapter 12 : SCHEMA Refinement And Normal Forms
12-1 to 12-32

Syllabus : Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition.

12.1 Functional Dependencies 12-1

12.1.1 Solved Examples on Functional Dependencies 12-2

12.1.2 Types of Functional Dependencies 12-4

12.2 FD Properties (Armstrong’s Axioms/ Closures of FD)..... 12-7

12.3 Decomposition Using FD 12-9

12.3.1 Goals12-10

12.3.2 Algorithm of Decomposition.....12-11

12.3.2(A) Lossless-join Decomposition12-12

12.3.2(B) Dependency Preservation.....12-12

12.3.2(C) Repetition of information.....12-13

12.4 Normalization12-14

12.4.1 Features of Good Database Design.....12-15

12.4.1(A) Purpose of Normalisation to Remove Pitfalls in Database Design.....12-15

12.5 Keys and Attributes in Keys.....12-18

12.6 First Normal Form (1NF)12-20

12.7 Second Normal Form (2NF)12-22

12.8 Third Normal Form (3NF)12-26

12.9 Boyce Codd Normal Form (BCNF).....12-28

Chapter 13 : Database Protection 13-1 to 13-6

Syllabus : Security Issues, Threats to Databases, Security Mechanisms, Role of DBA, Discretionary Access Control.

13.1 Database Security Issues..... 13-1

13.1.1 Threats to Databases 13-1

13.1.2 Security Levels..... 13-1

13.1.3 Security Mechanism 13-2

13.2 Access Control / Authorization in SQL13-2

13.3 DBA13-4

13.3.1 Database Administrator (DBA)13-4

13.4 Discretionary Access Control.....13-5

13.4.1 Creating a User13-5

13.4.2 Altering the User.....13-6

13.4.3 Dropping a User13-6

Chapter 14 : Views 14-1 to 14-8

Syllabus : Creating, altering dropping, renaming and manipulating views.

14.1 Concept of Views.....14-1

14.1.1 Creating a Views14-2

14.1.2 Dropping Views.....14-4

14.1.3 Modifying a Views.....14-5

14.1.4 Renaming Views14-5

14.1.5 Updating Views14-5

14.2 Advantages of Views.....14-6

14.3 Disadvantages of Views.....14-7

Chapter 15 : Data Control Language 15-1 to 15-8

Syllabus : Creating/dropping users, privileges introduction, granting/revoking privileges, viewing privileges), Transaction control commands – Commit, Rollback.

15.1 Data Control Language (DCL).....15-1

15.2 Creating Role and User15-1

15.2.1 Creating a User and Role15-1

15.2.2 Dropping a User and Role15-2

15.3 Database Privileges15-2

15.3.1 System privileges15-2

15.3.2 Object privileges15-2

15.3.3 Ownership Privileges15-3

15.3.4 Granting Privileges.....15-3

15.3.5 Some other types of privileges15-5

15.3.6 Revoking of Privileges15-5

15.4 Viewing Privileges..... 15-6

15.5 Transaction Control Language (TCL) 15-7

15.5.1 Roll Back and Commit..... 15-7

Chapter 16 : Index 16-1 to 16-8

Syllabus : Introduction, Primary index, Clustering Index, Multilevel indexes.

16.1 Index - Concept of Indexing..... 16-1

16.2 SQL Indexes..... 16-2

16.2.1 Creating of Index..... 16-5

16.2.1(A) Simple Index 16-5

16.2.1(B) Composite Index 16-6

16.2.1(C) Unique Index..... 16-6

16.2.2 Viewing Table Indexes..... 16-7

16.2.3 Removing Index 16-8

Chapter 17 : Data Backup And Restoring Database 17-1 to 17-14

Syllabus : Data Backing up, restoring database.

17.1 Database System Failure17-1

17.1.1 Types and Causes of Failure..... 17-1

17.2 Database Backup17-2

17.3 Database Recovery Concepts - Restoring Database17-4

17.4 Log-Based Recovery17-5

17.4.1 Deferred-Modification Technique (REDO Algorithm)..... 17-7

17.4.2 Immediate Modification Technique (UNDO Algorithm) 17-11