SQL COURSE OUTLINE

1. Introduction to Databases & SQL

- What databases are and why they matter
- What SQL is used for
- Types of databases (Relational vs non-Relational)
- Popular SQL engines (PostgreSQL, MySQL, SQL Server, Oracle)
- Client tools & environments (pgAdmin, DBeaver, SSMS)

2. SQL Installation &Environment Setup

- Installing PostgreSQL / MySQL
- Connecting to a database
- Database schemas and namespaces
- Tables vs views vs materialized views
- Understanding rows, columns, and records

3. Importing SQL Tables Using GUI Tools

- Purpose of GUI-based table import
- Importing tables using database management tools
- Mapping columns during import
- Common GUI import errors and fixes
- Data type mismatch errors
- Verifying successful table creation

4. SQL Query Structure (Core Foundation)

- SQL statement order
- SELECT–FROM–WHERE–ORDER BY–LIMIT pattern
- Mandatory vs optional clauses
- Writing readable SQL (formatting & indentation)
- Order of SQL execution (logical processing order)

5. SELECT Statement Fundamentals

- Selecting all columns (SELECT *)
- Selecting specific columns
- Best practices for column selection
- Avoiding unnecessary SELECT *

6. Column Aliases (AS)

- Purpose of column aliases in SQL
- Renaming columns in query output
- Creating aliases without using AS
- Using aliases to improve query readability

7. DISTINCT & Data Uniqueness

- Removing duplicate values
- DISTINCT on single columns
- DISTINCT on multiple columns
- How SQL defines row uniqueness
- Common mistakes with DISTINCT

8. ORDER BY – Sorting Query Results

- Purpose of the ORDER BY clause
- Sorting query results in ASC and DESC order.
- Default sorting behavior
- Best practices for sorting query results

9. LIMIT and OFFSET

- Restricting query results
- Sorting by multiple columns
- OFFSET and result pagination
- Practical use case for LIMIT

10. SQL Comments

- Why comments are important for readability and maintenance
- Single-line comments - -
- Multi-line comments using /* */
- Commenting out parts of a query for debugging
- When to avoid excessive commenting

11. Filtering Data with WHERE

- Purpose of WHERE clause
- Filtering numeric, text, and date data
- Comparison operators (=, !=, >, <, >=, <=)
- Logical operators (AND, OR, NOT)
- Using parentheses for logic control

12. Advanced Filtering Operators

- BETWEEN
- IN and NOT IN
- LIKE and wildcards
- ILIKE (case-insensitive search)
- Pattern matching best practices

13. Handling NULL Values

- Understanding NULL
- IS NULL vs IS NOT NULL
- Why = NULL fails
- NULLs in sorting
- NULL-safe logic patterns

14. Aggregate Functions

- COUNT
- SUM
- AVG

- MIN and MAX
- Aggregates with NULL values
- Aggregate vs non-aggregate columns

15. GROUP BY & HAVING

- Why GROUP BY exists
- Grouping data correctly
- GROUP BY rules
- HAVING vs WHERE
- Common GROUP BY errors

16. Mathematical & String Functions

- Arithmetic operations in SQL
- ROUND, CEILING, FLOOR
- CONCAT, LENGTH, UPPER, LOWER
- SUBSTRING
- TRIM and text cleaning
- Practical data-cleaning use cases

17. Date & Time Functions

- DATE, TIME, TIMESTAMP
- CURRENT_DATE & CURRENT_TIMESTAMP
- EXTRACT (year, month, day)
- Date arithmetic
- Formatting dates
- Time zone basics

18. Joins – Combining Tables

- Why joins are necessary
- INNER JOIN
- LEFT JOIN
- RIGHT JOIN
- FULL OUTER JOIN
- Join conditions & keys
- Avoiding Cartesian products

19. Advanced Join Concepts

- Joining multiple tables
- Self joins
- Joining on multiple columns
- Filtering joins correctly
- Join performance considerations

20. Subqueries

- What subqueries are
- Subqueries in WHERE
- Subqueries in SELECT
- Subqueries in FROM
- Correlated vs non-correlated subqueries

21. Common Table Expressions (CTEs)

- WITH clause
- Improving query readability
- Recursive CTEs
- CTEs vs subqueries
- Performance considerations

22. Set Operations

- UNION
- UNION ALL
- INTERSECT
- EXCEPT / MINUS
- When to use set operations

23. Window Functions

- OVER() clause
- PARTITION BY
- ORDER BY in window functions
- ROW_NUMBER, RANK, DENSE_RANK
- Running totals
- Moving averages

24. Data Modification Statements

- INSERT INTO
- INSERT multiple rows
- UPDATE
- DELETE
- TRUNCATE vs DELETE
- Transaction safety basics

25. Importing Tables Using SQL Queries

- Creating table using CREATE TABLE
- Importing data using INSERT INTO
- Bulk inserts and multi-row insert
- Handling constraints during import
- Managing data type mismatches
- Error handling in query-based imports

26. Database Constraints

- PRIMARY KEY
- FOREIGN KEY
- UNIQUE
- NOT NULL
- CHECK constraints
- Why constraints matter

27. Indexes & Performance Basics

- What indexes are
- How indexes improve performance
- When indexes hurt performance

- Primary vs secondary indexes
- Reading basic query plans

28. Views & Materialized Views

- Creating views
- Updating views
- Use cases for views
- Materialized views
- Refresh strategies

29. Indexes & Performance Basics

- What indexes are
- How indexes improve performance
- When indexes hurt performance
- Primary vs secondary indexes
- Reading basic query plans

30. Transactions & ACID Concepts

- What transactions are
- COMMIT & ROLLBACK
- ACID properties
- Isolation levels
- Common transaction issues

31. Real-World SQL Projects

- Employee database analysis
- Sales performance dashboard queries
- Customer segmentation
- Time-based reporting
- Data cleaning projects

32. SQL Interview Preparation

- Common interview questions
- Query challenges
- Joins & aggregation problems
- Optimization questions
- Whiteboard SQL logic

Course Completion Outcomes

By the end of this course, students can:

- ✓ *Write clean, efficient SQL queries*
- ✓ *Join and analyze multiple datasets*
- ✓ *Prepare data for BI tools*
- ✓ *Optimize queries for performance*
- ✓ *Work confidently as a data analyst, BI analyst, or backend developer*