# ADVANCED SQL COURSE

**Duration:** 45 Days  
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**Unit 1: Introduction to Databases and SQL (2 Days)**

* What is a Database?
* Types of Databases (Relational, NoSQL)
* DBMS vs RDBMS
* Introduction to SQL
* SQL Syntax, Structure and Use Cases

**Unit 2: Setting Up the Environment (1 Day)**

* Installing MySQL/PostgreSQL/SQLite
* SQL Clients and IDEs (DBeaver, MySQL Workbench, PgAdmin)
* Creating and Connecting to a Database
* Basic SQL Command Execution

**Unit 3: Data Types and Table Creation (2 Days)**

* SQL Data Types (INT, VARCHAR, DATE, etc.)
* CREATE TABLE, ALTER TABLE, DROP TABLE
* Constraints: NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, CHECK, DEFAULT
* AUTO\_INCREMENT and SERIAL

**Unit 4: DML – Data Manipulation Language (3 Days)**

* INSERT INTO
* UPDATE
* DELETE
* Truncate vs Delete
* Use of RETURNING in PostgreSQL

**Unit 5: DQL – Data Query Language (4 Days)**

* SELECT Statement
* DISTINCT Keyword
* Filtering using WHERE
* Logical Operators: AND, OR, NOT
* Comparison Operators: =, <>, >, <, >=, <=
* BETWEEN, IN, LIKE, IS NULL

**Unit 6: SQL Functions (4 Days)**

* String Functions: UPPER(), LOWER(), LENGTH(), SUBSTRING()
* Date Functions: NOW(), CURDATE(), DATEDIFF()
* Numeric Functions: ROUND(), CEIL(), FLOOR()
* Conversion Functions: CAST(), CONVERT()

**Unit 7: Joins and Relationships (5 Days)**

* Types of Joins: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL OUTER JOIN
* Self Join and Cross Join
* ON and USING clause
* JOIN with WHERE and GROUP BY
* Multi-table Joins

**Unit 8: Aggregation and Grouping (3 Days)**

* COUNT(), SUM(), AVG(), MIN(), MAX()
* GROUP BY Clause
* HAVING Clause
* Aggregation with JOINs

**Unit 9: Subqueries and Nested Queries (3 Days)**

* Single Row Subqueries
* Multiple Row Subqueries
* Subqueries in SELECT, WHERE, FROM, HAVING
* EXISTS and NOT EXISTS

**Unit 10: Views and Indexing (2 Days)**

* Creating and Using Views
* Updatable Views
* Indexing Basics
* Unique and Composite Index
* Indexing Impact on Performance

**Unit 11: DCL – Data Control Language (2 Days)**

* GRANT and REVOKE
* Creating Users and Assigning Roles
* Privileges: SELECT, INSERT, UPDATE, DELETE
* Role-Based Access Control

**Unit 12: TCL – Transaction Control Language (2 Days)**

* COMMIT and ROLLBACK
* SAVEPOINT
* ACID Properties
* Transactions in MySQL/PostgreSQL

**Unit 13: Advanced Querying Techniques (3 Days)**

* CASE Statements
* COALESCE and NULLIF
* Window Functions: RANK(), DENSE\_RANK(), ROW\_NUMBER(), LEAD(), LAG()
* CTEs (Common Table Expressions) and WITH Clause

**Unit 14: Stored Procedures and Triggers (3 Days)**

* Creating and Executing Stored Procedures
* IN, OUT, INOUT Parameters
* Triggers: BEFORE, AFTER INSERT/UPDATE/DELETE
* Practical Trigger Use Cases

**Unit 15: Normalization and Schema Design (2 Days)**

* 1NF, 2NF, 3NF, BCNF
* Designing Relational Schema
* Data Redundancy and Anomalies
* Keys: Candidate, Composite, Surrogate

**Unit 16: Real-Time Projects (4 Days)**

| **Day** | **Project Title** |
| --- | --- |
| 1 | SQL Based E-commerce Inventory Tracker |
| 2 | Student Management System with Normalized Schema |
| 3 | Hospital Database System with Joins, Triggers and Procedures |
| 4 | Live Dashboard with Aggregated Reports and Complex Queries |

**Unit 17: Optimization and Performance Tuning (2 Days)**

* Query Execution Plan
* EXPLAIN / ANALYZE
* Index Usage and Optimization
* Avoiding N+1 Query Problem
* Partitioning Basics

**Unit 18: Final Assessment + Viva (2 Days)**

* MCQ and Hands-on SQL Test
* Query Writing
* Schema Design and Optimization
* Viva/Presentation of Project