

B. TECH (Any Engineering Branch)

B.TECH – II / III SEMESTER (ESC / Professional Core / Skill Oriented Course)

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COURSE TITLE:

STRUCTURED QUERY LANGUAGE (SQL)

Course Objectives:

- Understand the fundamentals of relational database systems
 - Learn data definition, manipulation, and control using SQL
 - Design and query relational databases effectively
 - Apply advanced SQL concepts for data analysis
 - Understand database integrity, security, and optimization
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Course Outcomes:

After successful completion of the course, the student will be able to:

- C01: Understand database concepts and relational data models
C02: Create and manipulate databases using SQL commands
C03: Retrieve data using joins, subqueries, and set operations
C04: Apply constraints, views, indexes, and transactions
C05: Use advanced SQL features for real-world data analysis
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SYLLABUS

UNIT – I: Introduction to Databases & SQL

Introduction:

Database concepts, Need of databases, File system vs DBMS, Applications of DBMS

Database Models:
Hierarchical, Network, Relational models

Relational Database Concepts:
Tables, Rows, Columns, Attributes, Tuples

Keys:
Primary key, Foreign key, Candidate key, Composite key

Introduction to SQL:
History of SQL, Features of SQL, SQL standards

Basic SQL Commands:
SELECT, DISTINCT, WHERE, ORDER BY

UNIT – II: Data Definition & Data Manipulation

Data Definition Language (DDL):
CREATE, ALTER, DROP, TRUNCATE

Data Manipulation Language (DML):
INSERT, UPDATE, DELETE

Constraints:
NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, CHECK, DEFAULT

Data Types:
Numeric, Character, Date/Time

Built-in Functions:
Aggregate functions – COUNT, SUM, AVG, MIN, MAX

UNIT – III: Joins, Subqueries & Set Operations

Joins:
INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN

Subqueries:
Single-row subqueries, Multi-row subqueries, Correlated subqueries

Set Operations:
UNION, UNION ALL, INTERSECT, MINUS

Grouping Data:

GROUP BY, HAVING

Views:

Creating and using views

UNIT – IV: Advanced SQL & Transactions

Indexes:

Creating indexes, Types of indexes

Transactions:

ACID properties, COMMIT, ROLLBACK, SAVEPOINT

Database Security:

GRANT, REVOKE

Stored Database Objects:

Stored procedures, Functions

Triggers:

Before and After triggers

UNIT – V: Database Design & Optimization

Database Design:

Entity–Relationship (ER) model, ER diagrams

Normalization:

First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF)

Query Optimization:

Execution plans, Index usage

SQL for Data Analytics:

Window functions, Ranking functions (ROW_NUMBER, RANK, DENSE_RANK)

Introduction to NoSQL (Conceptual):

Difference between SQL and NoSQL

Text Books:

1.

2.
SQL, PL/SQL – The Programming Language of Oracle, Ivan Bayross
 3.
Learning SQL, Alan Beaulieu, O'Reilly
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Reference Books:

1.
Fundamentals of Database Systems, Ramez Elmasri & Shamkant Navathe
 2.
SQL Cookbook, Anthony Molinaro, O'Reilly
 3.
Oracle SQL by Example, Alice Rischert
 4.
High-Performance MySQL, Baron Schwartz, O'Reilly
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☒ Why this syllabus is IIT / Tier-1 aligned

- Starts from DBMS fundamentals
- Strong coverage of core + advanced SQL
- Includes transactions, optimization & analytics
- Perfect foundation for Data Analyst, Data Engineer, AI/ML pipelines