Database Topics for Commission Tests

1. Database Fundamentals

- Definition and purpose of a database
- Types of databases (Relational, NoSQL, Hierarchical, etc.)
- Components of a database system
- Advantages of databases over file systems
- Database Users (Database Administrators, Developers, End Users)

2. Database Models

- Relational database model
- Hierarchical database model
- Network database model
- Object-oriented database model
- Key differences between models

3. SQL (Structured Query Language)

- Basic SQL commands (SELECT, INSERT, UPDATE, DELETE)
- Data Definition Language (DDL) commands (CREATE, ALTER, DROP)
- Data Manipulation Language (DML) commands (SELECT, INSERT, UPDATE, DELETE)
- Data Control Language (DCL) commands (GRANT, REVOKE)
- Filtering data using WHERE, LIKE, IN, and BETWEEN
- Sorting data using ORDER BY
- Joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN)
- Subqueries and nested queries
- Aggregate functions (COUNT, SUM, AVG, MAX, MIN)
- GROUP BY and HAVING clauses

4. Database Design and Normalization

- Entity-Relationship (ER) diagrams

- Relationships (One-to-One, One-to-Many, Many-to-Many)

- Functional dependencies

- Normalization (1NF, 2NF, 3NF, BCNF)

- Denormalization

5. Keys and Constraints

- Primary key, Foreign key, Unique key, and Composite key

- Constraints (NOT NULL, UNIQUE, CHECK, DEFAULT, FOREIGN KEY)

6. Transactions and Concurrency Control

- Properties of transactions (ACID - Atomicity, Consistency, Isolation, Durability)

- Locking mechanisms (Shared lock, Exclusive lock)

- Deadlock and how to prevent it

- Isolation levels (Read Uncommitted, Read Committed, Repeatable Read, Serializable)

7. Indexing

- Purpose of indexing

- Types of indexes (Clustered, Non-clustered, Unique, Composite)

- Advantages and disadvantages of indexing

8. Database Administration

- Backup and recovery

- User roles and permissions

- Database security

- Performance tuning and optimization

9. NoSQL Databases

- Introduction to NoSQL

- Types of NoSQL databases (Document-based, Key-Value, Graph, Column-family)

- Differences between SQL and NoSQL

- Use cases of NoSQL databases

10. Advanced Topics (Optional but Important)

- Triggers, Views, and Stored Procedures
- Data Warehousing and Data Mining
- Big Data concepts and databases (e.g., Hadoop, Cassandra)
- Cloud databases (e.g., AWS RDS, Google Cloud Firestore)
- Database integration with applications