Database Management Systems (DBMS)

Unit	Course Topics	Hours
1	**Introduction to DBMS:** Data, database, DBMS, characteristics, database users, DBMS architecture, data abstraction, data independence	**4L**
2	**Entity–Relationship (ER) Modeling:** Entities, attributes, relationships, ER diagrams, keys, mapping constraints, generalization, specialization, aggregation	**6L**
3	**Relational Model:** Relational algebra, relational calculus, integrity constraints (key, entity, referential), tuples, schemas	**6L**
4	**SQL & Query Processing:** DDL, DML, DCL, CRUD operations, joins, nested queries, indexes, views, triggers, stored procedures	**6L**
5	**Normalization & Database Design:** Functional dependencies, 1NF, 2NF, 3NF, BCNF, multi-valued dependencies, 4NF, decomposition, schema refinement	**5L**
6	**Transaction Management & Concurrency:** ACID properties, schedules, locks, 2-phase locking, deadlocks, serializability, recovery techniques	**4L**
7	**File Organization & Emerging Database Technologies:** File structures, indexing (B/B+ trees), hashing, NoSQL DBs, distributed DBs, data warehousing basics	**4L**