

5 <sup>th</sup> Semester	RCS5C002	Database Management Systems	L-T-P 3-0-0	3 Credits
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**Objectives**

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques

**Module I:****(5 hours)**

**Introduction:** Purpose of Database System – Views of data – data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modelling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.

**Module II:****(10 hours)**

**Relational Model:** Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL

**Module III:****(7 hours)**

**Database Design:** Dependencies and Normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF

**Module IV:****(10 hours)**

**Transactions:** Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

**Module V:****(8 hours)**

**Implementation Techniques:** Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.

**Outcomes**

- Ability to Install, configure, and interact with a relational database management system
- Ability to master the basics of SQL and construct queries using SQL
- Ability to design and develop a large database with optimal query processing

**Books:**

- [1] A. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 7<sup>th</sup> Ed, Tata McGraw Hill, 2019.
- [2] C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8<sup>th</sup>ed, Pearson Education, 2006
- [3] RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7<sup>th</sup>Edition, Pearson/Addisionwesley, 2016

[4] Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003

**Digital Learning Resources:**

Course Name: Fundamentals of Database Systems  
Course Link: <https://nptel.ac.in/courses/106/104/106104135/>  
Course Instructor: Dr. Arnab Bhattacharya, IIT, Kanpur

Course Name: Introduction to Database Systems  
Course Link: <https://nptel.ac.in/courses/106/106/106106220>  
Course Instructor: Prof. P. Sreenivasa Kumar, IIT, Madras