| **U23CS404** | **Database Management Systems** | **L** | **T** | **P** | **J** | **C** |
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| **1.Course Description:** | | | | | | |
| This course offers a comprehensive exploration of Database Management Systems (DBMS) theory, focusing on essential concepts and principles underlying the design, implementation and optimization of databases. Students will explore into various topics, including an Introduction to Databases, Structured Query Language (SQL) & Procedural Language/SQL (PL/SQL), Transaction and Concurrency Control, Storage & Indexing, and NoSQL databases. The students will gain a deep understanding of database architectures, data modelling techniques, query languages, transaction management strategies, storage mechanisms, indexing methods and the role of NoSQL databases in modern data management. | | | | | | |
| **2.Course Objectives:** | | | | | | |
| 1. To learn about data models and fundamentals of database system 2. To develop queries with SQL 3. To understand the internal storage structures using different file and indexing techniques 4. To understand the basics of transaction processing- concurrency control techniques and recovery procedures 5. To learn the principles of non-structured database systems | | | | | | |
| **3.Syllabus:** | | | | | | |
| **Unit-I: Introduction to Databases** | | | | | | |
| Purpose of Database , Types and examples of Databases (RDBMS, NOSQL, In-memory Databases & Distributed SQL databases) , Relational Database System Architecture ; Views of Data , Schema architecture , Data Independence , Schema and instance ; Data Models , Benefits and Phases of Data Model ; ER Diagram: Symbols , Components , Relationships , Weak entities , Attributes , Cardinality , Extended ER Diagram , Examples ; Relational Data Model ; Keys ; Relational Algebra ; Normalization: 1NF, 2NF, 3NF, BCNF,4NF,5NF;  **Case Study:** ER Diagram on Online Streaming, Movie Ticket Recommendation, Bike Tracking | | | | | | |
| **Unit-II: SQL & PL/SQL** | | | | | | |
| SQL Fundamentals : DDL Commands , Create, Drop, Alter, Truncate, Rename ; Keys : Primary Key, Candidate Key, Super Key, Foreign Key ;DML Commands , DQL Commands : Select, Insert, Update, Delete, Any, All, In, Exists, Non-Exists, Union, Intersection ; Advanced SQL Features , Aggregate Functions : SUM, COUNT, AVG, MIN, MAX, EXPLAIN, COALESCE ; Clauses , Order By , Group By, Having, CASE, LIMIT,WITH Clause, Date Functions, String Functions ; Subqueries , Nested, Correlated, Joins : Inner, Outer, and Equi-Joins ; Order of Execution, Embedded SQL , Dynamic SQL ; Creation and Dropping of Views, Types of Views , Creation and Execution of Stored Procedures , Cursors : Opening, Fetching, and Closing ; Triggers : Creation, Insertion, Deletion, and Updating Database ; Exception Handling ; MySQL JDBC Connectivity  **Case Study:** Online Streaming, Movie Ticket Recommendation, Bike Tracking, Import/Export Random records from CSV file to MYSQL | | | | | | |
| **Unit-III: Transaction and Concurrency Control** | | | | | | |
| Transaction processing : ACID Properties , Failure and Recovery , Schedules , Serializability , Concurrency Control , Lock-based protocol , Isolation levels ; SQL Facilities for concurrency and recovery , Database Integrity, Security and Authorization  **Case Study**: ACID Properties in Online Streaming Database-\\ | | | | | | |
| **Unit-IV: Storage & Indexing** | | | | | | |
| Overview of Storage Techniques : File organization , RAID ; Indexing : Types of ordered indices , B & B+ tree ; Hashing : Static & Dynamic Hashing , Query Processing & Optimization , SQL Performance Tuning  **Case Study:** Indexing in Online Streaming Database to optimize the retrieval of data | | | | | | |
| **Unit-V: NOSQL** | | | | | | |
| Need for NO SQL , Characteristics of NOSQL , Key-value database , Columnar Databases , Apache Cassandra , Click House , Document Databases , MongoDB : CRUD operations with MongoDB , MongoDB JDBC Connectivity , MongoDB Testing , Graph Databases , Metabase  **Case study:** Conversion of Online Streaming Database (RDBMS) to MongoDB | | | | | | |
| **Text Books:** | | | | | | |
| 1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ― ”Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2013 2. RamezElmasri, Shamkant B. Navathe, ―”Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2014 | | | | | | |
| **References:** | | | | | | |
| **References Books:**   1. C.J.Date, A.Kannan, S.Swamynathan, ―”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2013 2. KrisitnaChodorow, "MongoDB – The Definitive Guide", O’ Reilly, 2013   **Video References:**   1. http[s://w](http://www.youtube.com/playlist?list=PLsjUcU8CQXGFFAhJI6qTA8owv3z9jBbpd)ww.y[outube.com/playlist?list=PLsjUcU8CQXGFFAhJI6qTA8owv3z9jBbpd](http://www.youtube.com/playlist?list=PLsjUcU8CQXGFFAhJI6qTA8owv3z9jBbpd) 2. http[s://w](http://www.youtube.com/watch?v=c5HAwKX-suM)ww.y[outube.com/watch?v=c5HAwKX-suM](http://www.youtube.com/watch?v=c5HAwKX-suM) 3. https://youtu.be/FNYdBLwZ6cE 4. https://youtu.be/qEhNHOEa5sE   **NPTEL /Online Courses:**   1. https://onlinecourses.NPTEL.ac.in/noc23\_cs41/preview 2. https://codewithmosh.com/p/complete-sql-mastery 3. http[s://w](http://www.udemy.com/course/nosql-databases-for-beginners/)ww.u[demy.com/course/nosql-databases-for-beginners/](http://www.udemy.com/course/nosql-databases-for-beginners/) | | | | | | |

**4. Course Outcomes:**

| CO. No. | Course Outcome | BTL | POs | PSOs |
| --- | --- | --- | --- | --- |
| U23CS404.1 | Use data models and depict a database system | K3 | 1, 2, 3, 4, 5, 9, 12 | 1,2,3 |
| U23CS404.2 | Design relations for various business requirements | K3 | 1, 2, 3, 4, 5, 9, 12 | 1,2,3 |
| U23CS404.3 | Understand the properties of the database and recovery process | K2 | 1, 2, 3, 4, 5, 9, 12 | 1,2,3 |
| U23CS404.4 | Understand the optimization techniques in database storage | K2 | 1, 2, 3, 4, 5, 9, 12 | 1,2,3 |
| U23CS404.5 | Design non-structured database systems in application development | K3 | 1, 2, 3, 4, 5, 9, 12 | 1,2,3 |

**5. Course Articulation Matrix:**

| **CO** | **PO**  **01** | **PO**  **02** | **PO**  **03** | **PO**  **04** | **PO**  **05** | **PO**  **06** | **PO**  **07** | **PO**  **08** | **PO**  **09** | **PO**  **10** | **PO**  **11** | **PO**  **12** | **PSO**  **01** | **PSO**  **02** | **PSO**  **03** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| U23CS404.1 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |
| U23CS404.2 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |
| U23CS404.3 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |
| U23CS404.4 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |
| U23CS404.5 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |
| Course to PO | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 2 | 1 |