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|---|---|
| **COURSE TITLE** | **ADVANCE DATABASE MANAGEMENT SYSTEM** |
| **COURSE CODE** | **01CE0310** |
| **COURSE CREDITS** | **4** |

**Objective:**

1 The objective of this course is to impart knowledge of advanced database concepts including transactions, concurrency control, security, indexing, hashing, query optimization, and PL/SQL programming. It aims to develop the ability to analyze database performance, apply advanced SQL techniques, and implement secure and efficient database applications.

**Course Outcomes:** After completion of this course, student will be able to:

1 Apply transaction concepts and concurrency control techniques to ensure database consistency.

2 Analyze database security threats and implement access control, authentication, and encryption mechanisms

3 Evaluate indexing and hashing techniques for efficient data access and query performance.

4 Analyze query optimization strategies and apply performance tuning methods.

5 Apply advanced SQL and PL/SQL constructs including cursors, triggers, and stored procedures in database applications.

**Pre-requisite of course:**Fundamental database concepts, ER modeling, relational model, normalization techniques, and basic SQL queries learned in Database Management Systems.

**Teaching and Examination Scheme**

| Theory Hours | Tutorial Hours | Practical Hours | ESE | IA | CSE | Viva | Term Work |
|---|---|---|---|---|---|---|---|
| 3 | 0 | 2 | 50 | 30 | 20 | 25 | 25 |

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Transaction & Concurrency Control:**<br>Transaction concept, ACID properties, Transaction states & Cycle,, Concurrency problems: Lost update, Dirty read, Phantom read, 2PL, Serializability,, Concurrency control techniques: Locking (shared/exclusive),, Shadow paging, Timestamp ordering, Multiversion concurrency control (MVCC), Deadlock detection, prevention, avoidance and recovery | 8 |
| 2 | **Database Security**<br>Database security requirements and challenges, User authentication & authorization, SQL injection attacks & prevention methods, Access control models: DAC, MAC, RBAC, Database encryption techniques, Security in cloud databases | 6 |

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 3 | **Indexing & Hashing**<br>Types of indexes: Primary, Secondary, Dense, Sparse, Clustered vs Non-clustered indexes, Multi-level indexing, Bitmap indexing, Tree-based indexing: B-Tree, B+ Tree (concepts, insertion & deletion overview), Static & Dynamic Hashing (Extendible Hashing, Linear Hashing), Comparison of indexing & hashing, Indexing in modern RDBMS (Oracle, MySQL, PostgreSQL) | 8 |
| 4 | **Query Optimization & Performance Tuning:**<br>Query processing steps, Heuristics-based optimization, Cost-based optimization, Query execution plans & analysis, Index optimization strategies, Partitioning & Sharding (performance-oriented view),, Query tuning practices in real-world DBMS | 6 |
| 5 | **Advanced SQL & PL/SQL:**<br>Advanced SQL constructs: Nested queries, Set operations (UNION, INTERSECT, EXCEPT), Complex joins, Views, Index usage in SQL queries, PL/SQL basics: Block structure, Variables, Control structures, Cursors: Implicit & Explicit, Stored Procedures & Functions, Triggers: Row-level & Statement-level, Exception handling, Packages in PL/SQL | 12 |
| **Total Hours** | | **40** |

**Suggested List of Experiments:**

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Practical 1**<br>Creating the Tables | 2 |
| 2 | **Practical 2**<br>Basic PL/SQL Block | 2 |
| 3 | **Practical 3**<br>Conditional Statements in PL/SQL | 2 |
| 4 | **Practical 4**<br>Exception Handling in PL/SQL | 2 |
| 5 | **Practical 5**<br>Implicit Cursors | 2 |
| 6 | **Practical 6**<br>Explicit Cursors | 2 |
| 7 | **Practical 7**<br>Parameterized Cursors | 2 |
| 8 | **Practical 8**<br>Creating & Using Views | 2 |
| 9 | **Practical 9**<br>Updatable & Non-Updatable Views | 2 |
| 10 | **Practical 10**<br>Stored Procedures – Basics | 2 |

**Suggested List of Experiments:**

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 11 | **Practical 11**<br>Stored Procedures with Parameters | 2 |
| 12 | **Practical 12**<br>Stored Functions & Triggers | 2 |
| 13 | **Practical 13**<br>Library Management System (Case Study) | 2 |
| 14 | **Practical 14**<br>Sales & Billing System (Case Study) | 2 |
| **Total Hours** | | **28** |

**Textbook :**

1 Database System Concepts, Silverschatz A., , Korth F. H. and Sudarshan S.,, Tata McGraw Hill, 2019

**References:**

1 Fundamentals of Database Systems, Fundamentals of Database Systems, Fundamentals of Database Systems, Fundamentals of Database Systems, Elmasri R. and Navathe, B. S., Pearson,, 2016

2 SQL, PL/SQL the Programming Language of Oracle, SQL, PL/SQL the Programming Language of Oracle, SQL, PL/SQL the Programming Language of Oracle, SQL, PL/SQL the Programming Language of Oracle, Bayross I, BPB Publications, 2009

**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery | | | | | |
|---|---|---|---|---|---|
| **Remember / Knowledge** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Higher order Thinking / Creative** |
| 0.00 | 0.00 | 50.00 | 25.00 | 25.00 | 0.00 |

**Instructional Method:**

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources:**

1 https://apex.oracle.com/en/
2 https://onlinecourses.nptel.ac.in/noc22_cs57/preview
3 https://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/labs/index.php
4 https://www.w3schools.com/sql/
5 https://www.oracle.com/in/database/