**Advanced DataBase Management Systems**

**TIU-PCA-T205**

**L-T-P: 3-1-0  Credit: 4**

**Course Objective**

1. To revise the previous concepts of database management systems
2. To provide the concepts of various types of dependencies and their interrelationships
3. To learn the uses of advanced SQL
4. To help students acquire the theoretical foundation of Database Management Systems.
5. To provide the concepts of Query Processing and Optimization
6. To provide the concepts of Distributed Databases
7. To provide the concepts of enhanced database models

**Course Outcome**

1. Explain the advanced features of database management systems and Relational databases.
2. Design conceptual models of a database UML- based modeling for real life applications
3. The knowledge of indexing and query optimization
4. Knowledge of using advanced SQL
5. Knowledge of advanced database models

**Detailed syllabus**

**Module 1:**

**Revisionary Concepts**

General introduction to database systems, Theory of functional dependency and normalization

·                 Multi value dependency and 4NF

·                 Join Dependency and 5NF

·                 Inclusion Dependencies and Template Dependency

·                 PJNF/DKNF

·                 Modeling temporal data

. Closure and its accuracy

**Module 2:**

**Database implementation and Tools**

Use of UML and its support for database design specifications

·                 Representing specialization and generalization in UML Class diagram.

·                 UML based design tools

·                 Automated database design tools.

**Module 3:**

**Advanced SQL**

* Assertion and views
* Cursors, triggers and stored procedures
* Embedded SQL, dynamic SQL, SQLJ
* Advanced Features of SQL
* Examples of above in Oracle

**Module 4:**

**OVERVIEW OF STORAGE AND INDEXING, DISKS AND FILES**

Data on external storage; File organizations and indexing; Index data structures;

Comparison of file organizations; Indexes and performance tuning. Memory hierarchy;

RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats.

TREE STRUCTURED INDEXING: Intuition for tree indexes; Indexed sequential access method;

B trees and B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice.

HASH-BASED INDEXING: Static hashing; Extendible hashing, Linear hashing, comparisons.

**Module 5:**

**Query Processing ,Evaluation and Optimization**

Query Execution: Introduction to Physical-Query-Plan Operators, One-Pass Algorithms for Database, Operations, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting, Two-Pass, Algorithms Based on Hashing, Index-Based Algorithms, Buffer Management, Parallel Algorithms for Relational Operations, Using Heuristics in Query Optimization, Basic Algorithms for Executing Query Operations.

 Measures of Query Cost

* Selection Operation,
* Sorting
* Join Operation
* other Operations
* Evaluation of Expression
* Transformation of Relational Expressions
* Role of Relational Algebra and Relational Calculus in query optimization
* Estimating Statistics of Expression
* Choice of Evaluation Plans
* Views and query processing
* Storage and query optimization

**Module 6:**

**Distributed Databases**

* Centralized versus non centralized Database
* Homogeneous and Heterogeneous DDBMS and their comparison
* Functions and Architecture
* Distributed database design, query processing in DDBMS
* Distributed concurrency management, deadlock management
* Distributed Commit Protocols: 2 PC and 3 PC
* Concepts of replication servers

**Module 7**

**ENHANCED DATABASE   MODELS**

**Unit 1: Object Oriented Database**

* Limitations of Relational databases
* The need of Object oriented databases
* Complex Data Types
* Structured Types and Inheritance in SQL
* Table Inheritance
* Data types (arrays, multi-set etc) and structure in Object oriented databases using SQL
* Object-Identity and Reference Types in SQL
* ODL and OQL
* Implementing O-R Features
* Persistent Programming Languages
* Object-Oriented versus Object-Relational
* An Example of Object oriented and object relational database implementation

**Unit 2: Database and XML**

* Structured Semi structure and unstructured data
* XML hierarchical tree data model
* Documents DTD and XML schema
* XML Documents & Database
* XML query and transformations
* Storage of XML data
* XML database applications

**Unit 3: Emerging Database Models, Technologies and Applications I**

* Multimedia database
* Geography databases, Gnome databases
* Knowledge databases, deductive databases and semantic databases
* Spatial database
* Information visualization

**Unit 4: Emerging Database Models, Technologies and Applications II**

* Mobile databases
* Web databases (JDBC, ODBC)
* Personal databases
* Digital libraries
* Data grids
* Wireless networks and databases

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**Recommended Books:**

**Main Reading:**

1. Elmasri, Navathe. Fundamentals of Database Systems (Third Edition), Pearson Education, 2004.

2. Database System Concepts, Fifth Edition, AviSilberschatz, Henry F. Korth, S. Sudarshan

3.Thomas M. Connolly, Carolyn Begg, Database Systems: practical approach to design, implementation, and management, Pearson Education Limited, (6th edition),2015 1292061189 978-

**Supplementary Reading:**

1. Introduction to Database Systems by CJ Date

2. Data base Systems design, Implementation, and Management by Rob & Coronel, Thomson, 5th Edition

3. P. Bhattacharyya and A.K. Majumder, Data base management system, TMH