

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
TEITC504	Advanced Database Management Systems	04 Hr/week	02 Hr/week	---	04	01	---	05

Course Code	Course Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam					
		Test1	Test2	Avg. of 2 Tests						
TEITC504	Advanced Database Management Systems	20	20	20	80	25	---	25	150	

Course Objectives:

1. To reinforce and strengthen the database concepts learned in the basic course in database technologies
2. To impart skills that can help design and implement advanced queries using Structured Query Language.
3. To equip students with knowledge to implement and integrate databases in actual applications.
4. To make students aware of how databases are actually stored and accessed.
5. To introduce advanced concepts of transaction management and recovery techniques.
6. To initiate awareness about the potential security threats that exist in database systems and how to tackle them

7. To introduce other database models like distributed and object based
8. To create awareness of how enterprise can organize and analyze large amounts of data by creating a Data Warehouse.

Course Outcomes: At the end of the course the student will be able to:

1. Construct complex queries using SQL to retrieve and manipulate information in a database.
2. Design and implement full-fledged real life applications integrated with database systems.
3. Clearly understand how databases are actually stored and accessed; How transaction ACID properties are maintained and how a database recovers from failures.
4. Apply security controls to avoid any type of security incidents on vital database systems.
5. Design advanced data systems using Object based systems or Distributing databases for better resource management.
6. Understand the importance of enterprise data and be able to organize data to perform analysis on the data and take strategic decisions.

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours	Weightage
1	Introduction	Reviewing basic concepts of a relational database, Basic SQL	01	0%
2	Advanced SQL	Complex Retrieval Queries using Group By, Recursive Queries, nested Queries ; Specifying Constraints as Assertions; Event Condition Action (ECA) model (Triggers) in SQL; Creating and working with Views in SQL; Database Programming: Embedded SQL, Dynamic SQL and SQLJ, Database Programming with Function Calls: JDBC; Stored Procedures in SQL, Embedded SQL, Dynamic SQL.	06	10%

3	Advanced Transaction Processing & Recovery	Review of ACID properties and Serializability; Multiversion Concurrency Control Techniques; Granularity of Data Items and Multiple Granularity Locking ; Advanced Database Recovery techniques like Write Ahead Logging (WAL), ARIES, Checkpoints.	06	10%
4	Data Security	Introduction to Database Security Issues; Discretionary Access Control Based on Granting and Revoking Privileges; Mandatory Access Control and Role-Based Access Control for Multilevel Security; SQL Injection; Introduction to Statistical Database Security Introduction to Flow Control	04	10%
5	Storage and Indexing	Operation on Files; hashing Techniques; Types of Single-Level Ordered Indexes; Multilevel Indexes; Dynamic Multilevel Indexes Using B-Trees and B+-Trees; Indexes on Multiple Keys.	04	10%
6	Distributed Databases	Types of Distributed Database Systems; Distributed Database Architectures; Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design; Query Processing and Optimization in Distributed Databases; Overview of Transaction Management in Distributed Databases; Overview of Concurrency Control and Recovery in Distributed Databases.	06	10%
7	Object Based Databases	Overview of Object Database Concepts; Object-Relational Features; Object Database Extensions to SQL; The Object Definition Language ODL; Object Database Conceptual Design; The Object Query Language OQL.	05	10%
8	Introduction to Data	The Need for Data Warehousing; Increasing Demand for Strategic Information; Inability of Past Decision Support System; Operational Vs Decisional Support System; 1.3 Data	02	5%

	Warehousing	Warehouse Defined; Benefits of Data Warehousing ; Features of a Data Warehouse; The Information Flow Mechanism; Role of Metadata; Classification of Metadata; Data Warehouse Architecture; Different Types of Architecture; Data Warehouse and Data Marts; Data Warehousing Design Strategies.		
9	Dimensional Modeling	Data Warehouse Modeling Vs Operational Database Modeling; Dimensional Model Vs ER Model; Features of a Good Dimensional Model; The Star Schema; How Does a Query Execute? The Snowflake Schema; Fact Tables and Dimension Tables;; he Factless Fact Table; Updates To Dimension Tables: Slowly Changing Dimensions, Type 1 Changes, Type 2 Changes, Type 3 Changes, Large Dimension Tables, Rapidly Changing or Large Slowly Changing Dimensions, Junk Dimensions, Keys in the Data Warehouse Schema, Primary Keys, Surrogate Keys & Foreign Keys; Aggregate Tables; Fact Constellation Schema or Families of Star.	06	15%
10	ETL Process	Challenges in ETL Functions; Data Extraction; Identification of Data Sources; Extracting Data: Immediate Data Extraction, Deferred Data Extraction; Data Transformation: Tasks Involved in Data Transformation, Data Loading: Techniques of Data Loading, Loading the Fact Tables and Dimension Tables Data Quality; Issues in Data Cleansing.	04	10%
11	Online Analytical Processing (OLAP)	Need for Online Analytical Processing; OLTP vs OLAP; OLAP and Multidimensional Analysis; Hypercubes; OLAP Operations in Multidimensional Data Model; OLAP Models: MOLAP, ROLAP, HOLAP, DOLAP;	04	10%

Text Books:

1. Elmasri and Navathe, “Fundamentals of Database Systems”, 6th Edition, PEARSON Education.
2. Korth, Silberchatz, Sudarshan, :”Database System Concepts”, 6th Edition, McGraw – Hill
3. Theraja Reema, “Data Warehousing”, Oxford University Press, 2009

References:

1. Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals”, Wiley India.
2. C. J. Date, A. Kannan, S. Swamynathan “An Introduction To Database Systems”, 8th Edition Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems” 3rd Edition - McGraw Hill
4. Ralph Kimball, Margy Ross, “The Data Warehouse Toolkit: The Definitive Guide To Dimensional Modeling”, 3rd Edition. Wiley India.

Oral Exam:

An oral exam will be held based on the above syllabus.

Term work:

Assign a case study for group of 2/3 students and each group to perform the following experiments on their case-study:

Suggested Practical List

1. Problem Definition and draw ER /EER diagram
2. Creation of the database: using constraints and triggers
3. Advanced SQL – must cover Views, nested and recursive queries.
4. Implementing an application and integrating with the database using JDBC, Dynamic and embedded SQL
5. Any one Database Hashing technique
6. Implementing and index using B or B+ trees.
7. Creating and querying an Object database. – Use ODL and OQL (Paper Exercise-Assignment)

8. Implementing a Distributed Database.
9. Demonstration of database security techniques – SQL injection, inference attacks etc.
10. Problem Definition for a Data Warehouse, Construction of Star Schema Model.
11. Creation of a DW and running OLAP operations on them (Roll up, Drill down, Slice, Dice, pivot)

Tools used:

1. Any Database software like Oracle, DB2, SQL Server, MY SQL or any other open source tools.
2. Programming to be done in JAVA.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.
5. Weightage of marks should be proportional to number of hours assigned to each module.