

Course code	Database Management System				L	T	P	J	C
CSE2004					2	0	2	4	4
Pre-requisite	-				Syllabus version				
					V. XX.XX				
Course Objectives:									
<p>This course imparts the students with background to understand, design, implement, and use database management systems. The course will highlight the significant functions of database management system. This course is devised to learn and explore.</p> <ul style="list-style-type: none">• Advantages of using a DBMS rather than a file system.• Designing an Entity-Relationship model for a real life application.• Mapping a database schema from ER model.• Evaluating relational schemas for design qualities• Optimize a query.• Basic concepts on transaction processing, concurrency control and recovery.• Fundamental view on unstructured data and its management.• Storage of databases and techniques to access them using various algorithms.									
Expected Outcome :									
<p>At the completion of this course, students should be able to do the following:</p> <ul style="list-style-type: none">• CO1: Comprehend the role of a database management system in an organization.• CO2: Design the structure and operation of the relational data model.• CO3: Develop a database project depending on the business requirements, considering various design issues.• CO4: Explain the concept of a database transaction processing• CO5: Comprehend the concept of database facilities including concurrency control, backup and recovery.• CO6: List the concepts of indexing and accessing methods• CO7: Review the fundamental view on unstructured data and its management									
Student Learning Outcomes (SLO):					1,5,7				
Module:1	DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE				5 hours		SLO: 5		
History and motivation for database systems –characteristics of database approach – Actors on the scene – Workers behind the scene – Advantages of using DBMS approach, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, The Database System Environment, Centralized and Client/Server Architectures for DBMSs, Classification of database management systems.									
Module:2	DATA MODELING				4 hours		SLO: 5		
Entity Relationship Model : Types of Attributes, Relationship, Structural Constraints – Relational Model ,Relational model Constraints – Mapping ER model to a relational schema – Integrity constraints									
Module:3	SCHEMA REFINEMENT				6 hours		SLO: 5,7		
Guidelines for Relational Schema - Functional dependency; Normalization, Boyce Codd Normal Form, Multi-valued dependency and Fourth Normal form; Join dependency and Fifth Normal form.									
Module:4	QUERY PROCESSING AND TRANSACTION PROCESSING				5 hours		SLO: 1,7		
Translating SQL Queries into Relational Algebra – heuristic query optimization – Introduction to Transaction Processing – Transaction and System concepts - Desirable properties of Transactions – Characterizing schedules based on recoverability – Characterizing schedules based on serializability									
Module:5	CONCURRENCY CONTROL AND RECOVERY TECHNIQUES				4 hours		SLO: 5,7		

Two-Phase Locking Techniques for Concurrency Control based on time stamp – Recovery concepts – Recovery based on deferred update – Recovery techniques based on immediate update – Shadow paging.				Control -
Module:6	PHYSICAL DATABASE DESIGN	3 hours	SLO: 1	
Indexing: Single level indexing, multi-level indexing, dynamic multilevel indexing.				
Module:7	RECENT TRENDS - NOSQL DATABASE MANAGEMENT	3 hours	SLO: 5	
Introduction, Need of NoSQL, CAP Theorem, different NoSQL data models: Key-value stores, Column families, Document databases, Graph databases.				
	Total Lecture hours:	30 hours		
Text Book(s)				
1.	R. Elmasri & S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 7 th Edition, 2015			
2.	Raghu Ramakrishnan, Database Management Systems, Mcgraw-Hill, 4 th edition, 2015			
Reference Books				
3.	A. Silberschatz, H. F. Korth & S. Sudershan, Database System Concepts, McGraw Hill, 6 th Edition 2010			
4.	Thomas Connolly, Carolyn Begg, Database Systems : A Practical Approach to Design, Implementation and Management, 6 th Edition, 2012			
5.	Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012.			
6.	Shashank Tiwari ,—Professional NoSql, Wiley ,2011			
Mode of Evaluation:				
List of Challenging Experiments (Indicative)		SLO: 14,17		
	Solve the problem using the following: 1. DDL: Creating Schema 2. DDL : Altering the schema 3. Constraint creation 4. DML : Populating the relations 5. DML: update, deletion 6. DDL: Drop relation 7. Subquery 8. Single row function and aggregate functions 9. Joins : Cartesian product, Inner Join, Left outer join, Right outer join, Full outer join PL/SQL 10. Control structures 11. Cursors: Implicit and Explicit cursor : 12. Iterations 13. Functions 14. Procedure 15. Exceptions: 16. Trigger DBA concepts 17. Backup	30 hours		

	18. Recovery XML Schema 19.XML,DTD,XQuery	
	<p><u>SAMPLE PROBLEMS</u></p> <p>Consider the following relations containing airline flight information: Flights(flno: integer, from: string, to: string,distance: integer, departs: time, arrives: time) Aircraft(aid: integer, aname: string, cruisingrange: integer)</p> <p>Certified(eid: integer, aid: integer) Employees(eid: integer, ename: string, salary: integer)</p> <p>Note that the Employees relation describes pilots and other kinds of employees as well</p>	
2.	<p>SAILORS (<u>SID</u>:INTEGER, SNAME:STRING, RATING:INTEGER, AGE:REAL)</p> <p>BOATS (<u>BID</u>:INTEGER, BNAME:STRING, COLOR:STRING)</p> <p>RESERVES (<u>SID</u>:INTEGER, <u>BID</u>:INTEGER, <u>DAY</u>:DATE)</p> <p>Display names & ages of all sailors. Find all sailors with a rating above 7. Display all the names & colors of the boats. Find all the boats with Red color. Find the names of sailors who have reserved boat number 123. Find SIDs of sailors who have reserved Pink Boat; Find the color of the boats reserved by Rajesh. Find names of the sailors who have reserved at least one boat. Find the names of sailors who have reserved a red or a green boat. Find the names of sailors who have reserved boat 103. Find the names of sailors who have not reserved boat 103. Find sailors whose rating is better than some sailor called Rajesh. Find the sailor's with the highest rating using ALL. To count number SIDs of sailors in Sailors table To count numbers of boats booked in Reserves table. To count number of Boats in Boats table. To find age of Oldest Sailor. To find age of Youngest Sailor. Find the average age of sailors with a rating of 10. Count the number of different sailor names. Find the name and age of the oldest sailor. Count the number of Sailors.</p> <p>Find the names of sailors who are older than the oldest sailor with a rating of 10.</p> <p>Display all the sailors according to their ages.</p> <p>To display names of sailors according to alphabetical order.</p>	
3.	<p>Design the data base for a wholesale furniture company. The database has to allow to analyze the company's situation at least with respect to the Furniture, Customers and Time. Moreover, the company needs to analyze:</p> <p>the furniture with respect to its type (chair, table, wardrobe, cabinet. . .), category (kitchen, living room, bedroom, bathroom, office. . .) and material (wood, marble. . .)the customers with respect to their spatial location, by considering at least cities, regions and states The company is interested in learning at least the quantity, income</p>	

	and discount of its sales.																	
4.	<p>Simple script to backup all SQL server database</p> <p>Create a database table with the following fields:</p> <table><tr><td>Field name</td><td>Data type</td></tr><tr><td>Ship id</td><td>Number – This is the ID of a particular ship</td></tr><tr><td>Date_expected</td><td>Date – The data at which the goods are expected to arrive</td></tr><tr><td>Qty_expected</td><td>Number – The quantity that is supposed to arrive</td></tr><tr><td>Description</td><td>Varchar 2 – The description of the items</td></tr><tr><td>Color</td><td>Varchar 2 – The colour of the items</td></tr><tr><td>Qty_hand</td><td>Number – The quantity on hand for these items</td></tr><tr><td>Item rate</td><td>Number – Price of each item</td></tr></table> <p>Write a PL/SQL program that uses implicit cursor to display the data expected, quantity expected, item description, color and quantity on hand for any particular Ship ID number.</p>	Field name	Data type	Ship id	Number – This is the ID of a particular ship	Date_expected	Date – The data at which the goods are expected to arrive	Qty_expected	Number – The quantity that is supposed to arrive	Description	Varchar 2 – The description of the items	Color	Varchar 2 – The colour of the items	Qty_hand	Number – The quantity on hand for these items	Item rate	Number – Price of each item	
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5.	Consider an application in which the results of football games are to be represented in XML,DTD and Xquery. For each game, we want to be able to represent the two teams involved, which one was playing at home, which players scored goals (some of which may have been penalties) and the time when each was scored, and which players were shown yellow or red cards. You might use some attributes. You can check your solutions with the online demo of the Zorba XQuery engine4 .																	
6.	Backup : Create a transparent audit system for a table Client_master (client_no, name, address, Bal_due). The system must keep track of the records that are being deleted or updated. The functionality being when a record is deleted or modified, the original record details and the date of operation are stored in the auditclient(client_no, name, bal_due, operation, userid, update) table, then the delete or update is allowed to go through.																	
7.	Recovery: Using the supplier and parts database, write an cursor program to read and print all parts in part number, deleting every tenth one as you go, and begin a new transaction after every tenth row. You can use the foreign key delete CASCADE rule from parts, commit, roll back and save point .																	
8.	Assuming a patient should not receive both treatment and prescription from the same doctor, write a program to find out all the doctor who provide both treatment and prescription to the same patient. In addition, raise and display an exception if this situation occurs.																	
9.	Write a PL/SQL block which includes a procedure get Cleaner Details which accepts a cleaner number and returns the cleaners name and salary. Create a stored function called get Cleaners Location. This function takes as input a cleaner’s number and returns the cleaner’s depot address. Call the function from within an SQL statement to select the cleaner’s name and location for a particular cleaner.																	
10.	Create a Trigger that raises an User Defined Error Message and does not allow the update and Insert operation in the database																	
11.	<p><u>Join Queries : Assume necessary database schema</u></p> <ul style="list-style-type: none">□ Display the name of each employee with his department name.□ Display a list of all departments with the employees in each department.□ Display all the departments with the manager for that department.□ Display the names of each employee with the name of his/her boss.																	

	<ul style="list-style-type: none"> <input type="checkbox"/> Display the names of each employee with the name of his/her boss with a blank for the boss of the president. <input type="checkbox"/> Display the employee number and name of each employee who manages other employees with the number of people he or she manages. • Repeat the display for the last question, but this time display the rows in descending order of the number of employees managed. 	
	<p>Students are advised to complete a project work which involves the following database steps (whichever is essential).</p> <ul style="list-style-type: none"> • Choose an real world scenario and write abstract • Model the ER Diagram for a specific application • Convert the ER model into relational model • Establish the relationship between relations • Apply the normalization techniques • Use any DBMS software and create the relations. • Create GUI using any front end tool • Establish Connection between front end and back end. • Querying the database and Generating Report 	
	<p>Sample Projects</p> <ul style="list-style-type: none"> • Design a tool to measure the performance of database by considering the following Factors <ul style="list-style-type: none"> a) Throughput A system's throughput defines its overall capability to process data. DBMS throughput is measured in queries per second, transactions per second, or average response times. b) Contention : Contention is the condition in which two or more components of the workload attempt to use the system in a conflicting way — for example, multiple queries that try to update the same piece of data at the same time or multiple large workloads that compete for system resources. As contention increases, throughput decreases. c) optimization DBMS optimizations can affect the overall system performance. SQL formulation, database configuration parameters, table design, data distribution, and so on enable the database query planner and optimizer to create the most efficient access plans. 	
	<p>Optimistic concurrency control and compare its performance to the basic concurrency control scheme of a simple database</p> <p>More specifically, OCC transactions involve these phases:</p> <p>Begin: Record a timestamp marking the transaction's beginning.</p> <p>Modify: Read database values, and tentatively write changes.</p> <p>Validate: Check whether other transactions have modified data that this transaction has</p>	

	used (read or written). This includes transactions that completed after this transaction's start time, and optionally, transactions that are still active at validation time. Commit/Rollback: If there is no conflict, make all changes take effect. If there is a conflict, resolve it, typically by aborting the transaction, although other resolution schemes are possible.	
	Twitter data filtering, aggregating, analyzing and extracting valuable information.	
	Implement the performance improvement of the database in client side and offload work from the server, example use HTML browsers (including WebKit, used by Safari and Chrome), include a client-side SQL API in JavaScript	
	Social Network data Analysis using NoSQL (social networking sites like Facebook, LinkedIn, Twitter, MySpace, Foursquare, Flickr and Friendfeed)	
	Healthcare organization database system: usage of the following data base repositories is preferable http://www.ehdp.com/vitalnet/datasets.htm , https://data.medicare.gov/data/hospital-compare , http://www.hscic.gov.uk/datasets	
	Create a DTD for a small XML data set about world countries. This data can be adapted from the Mondial 3.0 database. Each country has a name, population, and area (in sq. km). Some countries also list languages (with percentages of the population that speaks each language) and/or cities (with names and populations).Analyse the XML schema using necessary Xquery and create a report that describe the insight of data	
Mode of evaluation:		
Recommended by Board of Studies		DD-MM-YYYY
Approved by Academic Council		No. xx Date DD-MM-YYYY

CO-PO MAPPING:

	PO 1	PO 5	PO 7
CO1	*		
CO2		*	
CO3		*	*
CO4	*		*
CO5		*	*
CO6	*		
CO7	*		

CO Mapping with Assessments

From here it is to be done by the course co-ordinator consultation:

- CAT 1
- CAT 2
- A1, A2, A3 (DA's and Quiz)
- FAT

	CAT-1	CAT-2	A1	A2	A3	FAT
CO1	X		X	X		X
CO2	X		X	X		X
CO3		X	X		X	X
CO4		X	X		X	X
CO5					X	X
CO6					X	X
CO7						X