BCSE302L	Database Systems	L	T	P	C
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Pre-requisite	**NIL**	**Syllabus version**			
		1.0			

Course Objectives

1. To understand the concepts of File system and structure of the database; Designing an Entity-Relationship model for a real-life application and Mapping a database schema from the ER model.
2. To differentiate various normal forms, evaluate relational schemas for design qualities and optimize a query.
3. To impart the working methodologies of transaction management, understand concurrency control, recovery, indexing, access methods and fundamental view on unstructured data and its management.

Course Outcomes

On completion of this course, student should be able to:

1. Comprehend the role of database management system in an organization and design the structure and operation of the relational data model.
2. Develop a database project depending on the business requirements, considering various design issues.
3. List the concepts of indexing and accessing methods.
4. Explain the concept of a database transaction processing and comprehend the concept of database facilities including concurrency control, backup and recovery.
5. Review the fundamental view on unstructured data and describe other emerging database technologies.

Module:1	**Database Systems Concepts and Architecture**	**4 hours**

Need for database systems – Characteristics of Database Approach – Advantages of using DBMS approach - Actors on the Database Management Scene: Database Administrator - Classification of database management systems - Data Models - Schemas and Instances - Three-Schema Architecture - The Database System Environment - Centralized and Client/Server Architectures for DBMSs – Overall Architecture of Database Management Systems

Module:2	**Relational Model and E-R Modeling**	**6 hours**

Relational Model: Candidate Keys, Primary Keys, Foreign Keys - Integrity Constraints - Handling of Nulls - Entity Relationship Model: Types of Attributes, Relationships, Structural Constraints, Relational model Constraints – Mapping ER model to a relational schema – Extended ER Model - Generalization – Specialization – Aggregations.

Module:3	**Relational Database Design**	**6 hours**

Database Design – Schema Refinement - Guidelines for Relational Schema - Functional dependencies - Axioms on Functional Dependencies- Normalization: First, Second and Third Normal Forms - Boyce Codd Normal Form, Multi-valued dependency and Fourth Normal form - Join dependency and Fifth Normal form

Module:4	**Physical Database Design and Query Processing**	**8 hours**

File Organization - Indexing: Single level indexing, multi-level indexing, dynamic multilevel Indexing - B+ Tree Indexing – Hashing Techniques: Static and Dynamic Hashing – Relational Algebra - Translating SQL Queries into Relational Algebra - Query Processing – Query Optimization: Algebraic Query Optimization, Heuristic query optimization Rules, Join Query Optimization using Indexing and Hashing - Tuple Relational Calculus.

Module:5	**Transaction Processing and Recovery**	**8 hours**

Introduction to Transaction Processing – Transaction concepts: ACID Properties of Transactions, Transaction States - Serial and Serializable Schedules - Schedules based on recoverability – Schedules based on Serializability - Conflict Serializabilty - Recovery Concepts: Log Based Recovery Protocols, Recovery based on deferred update, Recovery techniques based on immediate update – Shadow Paging Algorithm		
Module:6	**Concurrency Control In Transaction Processing**	**8 hours**
Concurrent Transactions – Lost Update Problem - Concurrency Control Techniques: Time Stamp Based Protocols, Thomas Write Rule, Lock Based Protocols, Lock Compatibility Matrix, - Two-Phase Locking Protocol - Lock Conversions - Graph Based Protocols for Concurrency Control - Tree Protocol for Concurrency Control – Deadlocks Based on Locks in Transactions – Deadlock Handling Techniques – Transaction Deadlock Detection Techniques – Transaction Deadlock Prevention Techniques – Multi-Granularity Locking for avoiding Transaction Deadlocks		
Module:7	**NOSQL Database Management**	**3 hours**
Introduction, Need of NoSQL, CAP Theorem, different NoSQL data bases: Key-value data stores, Columnar families, Document databases, Graph databases		
Module:8	**Contemporary Issues**	**2 Hours**
	Total Lecture hours:	**45 hours**

Text Book	
1.	R. Elmasri & S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 7th Edition, 2016
Reference Books	
1.	A. Silberschatz, H. F. Korth & S. Sudarshan, Database System Concepts, McGraw Hill, 7th Edition 2019.
2.	Raghu Ramakrishnan, Database Management Systems, Mcgraw-Hill, 4th Edition, 2018
3.	C.J.Date, A.Kannan, S.Swamynathan," An Introduction to Database Systems", Pearson, Eighth Edition, 2006.
4.	Gerardus Blokdyk, NoSQL Databases A Complete Guide, 5STARCooks, 2021

Mode of Evaluation: CAT, Written assignments, Quiz and FAT.			
Recommended by Board of Studies	04-03-2022		
Approved by Academic Council	No. 65	Date	17-03-2022