Course Code	Course name	L	T	P	C
CSEG2046	Database Management Systems	3	0	0	3
Total Units to be Covered: 7		Total Contact Hours: 45			
Prerequisite(s):	Exposure on Data structures.	Syllabus version: 1.0			

Course Objectives

1. To understand the concept of DBMS and ER Modelling.
2. To explain normalization, Query optimization and relational algebra.
3. To apply concurrency control, recovery, security and indexing for real time data.

Course Outcomes

CO 1 Understand the foundational concepts of data models, schema design, and relational databases to effectively manage and query data.

CO 2 Learn to design efficient and normalized databases, apply entity-relationship modeling, and optimize schema structures.

CO 3 Acquire skills in database security, user access control, backup and recovery, and performance tuning to ensure robust database management.

CO 4 Develop database application design and its implementation including integrity constraints, transaction management and concurrent control algorithms.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO 2	-	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO 3	-	3	2	3	-	-	-	-	-	-	-	-	2	3	-
CO 4	-	3	2	3	-	-	-	-	-	-	-	-	2	3	-
Average	-	3	2	2.5	-	-	-	-	-	-	-	-	2	3	-

1 – Weakly Mapped (Low) **2 – Moderately Mapped (Medium)**

3 – Strongly Mapped (High) **"_" means there is no correlation**

Syllabus

Unit I: Introduction to Databases **6 Lecture Hours**

Introduction to Database, Database users, characteristics and advantages of the database, Database systems, Concepts and architecture-Data models, schemas & instances, Three-Schema architecture & data independence, database languages & interfaces, Centralized and Client/Server Architecture of DBMS.

Unit II: Data Modelling **7 Lecture Hours**

Data Modelling, Using the Entity Relationship (ER) Model, The Enhanced Entity-Relationship (EER) Model: - Entity Set, attributes and their types, Relationship Constraints (including Participation constraints and cardinality ratio), ER Diagrams, constraints and design issues, Reduction of ER and EER diagram to relational schemas. UML Class Diagrams.

Unit III: Relational Database Design and Normalization **7 Lecture Hours**

Relational model Concepts, Relational model constraint & relational database schemas, transactions, and dealing with constraint Violation, DBMS Keys, Relational Algebra, Unary relational operation, Binary relational operations and, relational algebra operations from set Theory, Relational Calculus; and implementation in SQL, Informal Design guideline for relational Schemas, Functional Dependencies, Normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition, Multivalued dependencies (4NF, 5NF), domain key normal form.

SQL- Queries, Constraints, Form of SQL query, UNION, INTERSECT and EXCEPT, Nested queries, Aggregate Operators, Null values, Complex Integrity constraints in SQL and triggers.

Unit IV: DBMS Architecture, Query Processing and Optimization **7 Lecture Hours**

DBMS Instance, DBMS Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Introduction to Query Processing, Translating SQL Queries into Relational Algebra, Algorithms for External Sorting, Algorithms for SELECT and JOIN Operations, Algorithms for PROJECT and SET Operations, Implementing Aggregate Operations and Outer Joins.

Unit V: Disk Storage, File Structures, and Indexing **5 Lecture Hours**

Introduction, Secondary Storage Devices, Buffering of Blocks and Placing File Records on Disk, Operations on Files, Heap Files, Sorted Files, Hashing Techniques, Parallelizing Disk Access using RAID Technology, Secondary Access Paths, Types of Single-Level Ordered Indexes, Multilevel Indexes, Dynamic Multilevel Indexes Using B-Trees and B+ Trees, Indexes on Multiple Keys

Unit VI: Transaction Management, **7 Lecture Hours**

Concurrency Control and Recovery

Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules based on Recoverability, Characterizing Schedules based on Serializability. Introduction to Concurrency Control, Two Phase Locking Techniques, Concurrency Control on Timestamp Ordering, Validation Concurrency Control Techniques, Granularity of Data items and Multiple Granularity Locking, Recovery Concepts, Recovery Techniques Based on Deferred and Immediate Update, Shadow Paging.

Unit VII: NoSQL Database Management **6 Lecture Hours**

Introduction, Need of NoSQL, different NoSQL data models, Introduction to MongoDB, Datatypes, Document Data Model-Creating, Inserting, Updating and Deleting Documents, MongoDB Query Language, Indexing, Aggregation, Sharding in MongoDB, Join Operations, Pagination.

Total lecture Hours 45

Textbooks

1. Ramez Elmasri, and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson India, 2017.

2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Mcgraw-Hill, 2015.

Reference Books

1. A. Silberschatz, H. F. Korth, and S. Sudershan, "Database System Concepts", 6th ed., McGraw Hill, 2013.

2. Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, "Database Systems-The Complete Book", 2nd Edition, Pearson India Pearson Education, 2011.

3. Pramod J. Sadalage, and Marin Fowler, "NoSQL Distilled: A brief guide to merging world of Polyglot persistence", Addison Wesley, 2012.

4. Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, 2019.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme

Components	IA	MID SEM	End Sem	Total
Weightage (%)	50	20	30	100