CS 6106 DATA BASE MANAGEMENT SYSTEMS

Pre-requisites for the course: None

OBJECTIVES:

- To learn the fundamentals of data models and to conceptualize and represent a database system using ER diagram
- To study the principles to be followed to create an effective relational database design and effectively write SQL queries to retrieve/ store data from/to database
- To know the fundamental concepts of transaction processing-concurrency control techniques and recovery procedure
- To have an introductory knowledge about the storage and query processing techniques and the basic concepts of Information retrieval techniques
- To learn about the internal storage structures using different file and indexing techniques which will help in physical DB design

DATABASE MANAGEMENT SYSTEMS	**L**	**T**	**P**	**EL**	**CREDITS**
	3	**0**	**4**	**3**	**6**

MODULE I:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**2**

Introduction to Databases- File System Vs Database System - Data Models- Schemas and Instances - DBMS Architecture- Centralized - Client Server - Database Applications

SUGGESTED ACTIVITIES:

- In class activity for various database applications

SUGGESTED EVALUATION METHODS:

- Tutorial: scenarios to analyze the need for DB in various applications
- Practical - Installation of Open Source DBMS software and perform basic DB operations like creating sample tables and populating the instances
- Quizzes

MODULE II:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Entity Relationship (ER) Model - conceptual design of DB Application - ER diagram - Design issues - Relationship types - other notations - Extended Entity-Relationship (EER) Model - ER to Relational Mapping

SUGGESTED ACTIVITIES:

- In class activity: defining the participating entities and their relations for a given scenario
- Practical –Use OSS to draw the ERD depicting the attributes, cardinality and other relationships

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE III:	L	T	P	EL
	6	0	4	6
Relational Data Model - Operations on Relational Model - Specifying Constraints Relational Algebra - Unary, Binary, Set and other Operations - Tuple and Domain Relational Calculus. SQL - Data Definition - Data Manipulation and Retrieval Queries				
SUGGESTED ACTIVITIES: • In Class - ER Model to Relational Model mapping • Practical - ER Modeling using open source tools and Schema realization				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				
MODULE IV:	**L**	**T**	**P**	**EL**
	4	**0**	**4**	**3**
Database Design - Functional Dependencies - Normal Forms - 1 NF - 2 NF - 3 NF - BCNF - Multivalued Dependency - Join Dependency				
SUGGESTED ACTIVITIES: • In Class - Normalization • Flipped class room - Database design validation through Normalization, Understanding the functional dependency across the attributes in the relation. • Practical – Creation of schema using Data Definition language and Instances using the Data Manipulation language commands • Practical – Simple SQL query construction using keywords				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				
MODULE V:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**
Complex SQL Queries - Nested Queries - Correlated Nested Queries - Various Types of Joins - Aggregate Functions - Grouping - Triggers – Views – Embedded and Dynamic SQL				
SUGGESTED ACTIVITIES: • In Class - SQL Queries and Joins • Practical - Implementation of complex SQL Queries (Joins, Sub queries, inbuilt functions) and Triggers • EL – Understand the features in other commercial or open-source DBMS				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				
MODULE VI:	**L**	**T**	**P**	**EL**
	5	**0**	**4**	**3**
Transaction processing concepts -Need for concurrency control and recovery- ACID Properties - Recoverability - Serializability				

SUGGESTED ACTIVITIES:

- In Class –examples to understanding the real-world scenarios like concurrency in transactions
- Practical - Implementation of complex procedures (PL/SQL Procedures) and transactions involving shared variables

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE VII:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Concurrency Control - Two phase locking Techniques - Timestamp Ordering - Granularity - Recovery - Deferred Update - Immediate Update - Deadlocks

- In Class – examples to understanding the real-world scenarios like concurrency, deadlock and recovery in transactions
- Practical - Implementation of complex procedures (PL/SQL functions) and transactions involving shared variables

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE VIII:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Query Processing - SQL Query Translation - Pipelining - Query Optimization - Cost Estimation - Semantic Query Optimization

SUGGESTED ACTIVITIES:

- EL – Methods for optimizing the query in terms of space and time complexity
- In Class - Query Translation and Optimization
- Flipped classroom - cost-based query optimization for complex SQL queries
- Practical – Cost estimation for a query using OSS

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE IX:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Indexing - Single-Level and Multilevel Index - Multiple Key Index - Indexing Issues. Hashing

SUGGESTED ACTIVITIES:

- EL – efficient methods for storage and retrieval
- In Class - Selecting the Index types for a scenario and discuss the efficiency
- Flipped Classroom – Issues on selection of attribute in a relation for Indexing / Hashing
- Practical – Use OSS to compare the efficiency of the various available methods of storage and retrieval

SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				
MODULE X:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**
Introduction to Database Tuning - Data Warehousing and Mining – Spatial and Temporal Databases – OO Databases, NoSQL				
SUGGESTED ACTIVITIES: • EL – Applications that use Spatial and temporal data • In Class – Analyzing the tuning parameters that corresponds to high performance. • Flipped Classroom – Demonstrate the operations on Data in Data warehouse & mine specific patterns • Practical – Use OSS to perform the operations in DW & M				
SUGGESTED EVALUATION METHODS: • Assignment problems • Project demonstration and presentation				

OUTCOMES:

Upon completion of the course, the students will be able to:

- Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model
- Formulate solutions to a broad range of query problems using relational algebra/ SQL
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database
- Run transactions and estimate the procedures for controlling the consequences of concurrent data access
- Discuss the basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing
- Point out the basics of query evaluation techniques and query optimization

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson/Addison - Wesley, 2016.

REFERENCES:

1. C.J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. Narain Gehani and Melliyal Annamalai, "The Database Book: Principles and Practice Using the Oracle Database System", Universities Press, 2012.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley, 2012.

EVALUATION METHOD TO BE USED:

Continuous assessment	Mid term	End Semester
15(T) + 25 (P)	20	40

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								
CO2	✓	✓		✓	✓							
CO3	✓		✓	✓	✓							
CO4	✓	✓		✓								
CO5	✓	✓			✓							
CO6	✓	✓	✓	✓								

CS 6107 COMPUTER ARCHITECTURE

Prerequisites for the course: None

OBJECTIVES:

- To identify the requirements of different types of computer systems
- To understand the evaluation of computer systems based on various performance metrics
- To study the characteristics of the ISA and the hardware software co-design
- To trace the execution sequence of an instruction through the processor
- To compare different approaches used for implementing a functional unit
- To understand the fundamentals of memory and I/O systems and their interaction with the processor

COMPUTER ARCHITECTURE	L	T	P	EL	CREDITS
	3	0	2	3	5

MODULE I :	L	T	P	EL
	3	0	2	3

Introduction - Classes of computer systems - Performance - Amdahl's law - The Power wall - Switch from uniprocessors to multiprocessors – Benchmarks.

SUGGESTED ACTIVITIES :

- In Class activity for performance evaluation
- EL - Evolution of computer systems, identification of benchmarks
- Practical – Demonstration - Opening up a computer system and studying the components