MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus of B. Sc. in IT
(Effective from 2023-24 Academic Sessions)

SEMESTER: III

Paper: Study of Data structure and Algorithms
Code: BSCITM301 + BSCITM391
Contacts Hours/ Week: 4L + 4P
Credits: 3+2

COURSE OBJECTIVE:

The course aims to provide students with a solid foundation in fundamental data structures and algorithms, as well as proficiency in implementing them using C. This will empower students with the knowledge, skills, and problem-solving abilities necessary to tackle complex computational problems and excel in their academic and professional pursuits in the field of computer application.

Course Outcome:

CO	Course Outcome Description
CO1	Students will comprehend the fundamental concepts of data structures, including arrays, linked lists, stacks, queues, trees and graphs, and how they are implemented in the C programming language.
CO2	Gain proficiency in implementing various data structures using C programming language, including dynamic memory allocation, pointers, and structures.
CO3	Develop the ability to analyze problems and choose appropriate data structures and algorithms to solve them efficiently.
CO4	Enhance problem-solving skills by applying data structures and algorithms to solve real-world problems and algorithmic challenges.
CO5	Collaborate effectively in team projects involving the design and implementation of complex data structures and algorithms, fostering communication and teamwork skills.

Module No.	Name of the Topic	Hours	Marks
M1	**Arrays:** 1D, 2D and Multi-Dimensional Arrays, Sparse Matrices, Polynomial representation, Implementation of Stack and Queue, Example of Infix, Postfix, and prefix, Priority Queue	7	10
M2	**Linked Lists:** Singly, Doubly and Circular Lists, Normal and Circular representation of Self Organizing Lists, Skip Lists, and Polynomial representation.	8	8
M3	**Recursion:** Definition, Internal Stack representation, Factorial function, Fibonacci Sequence, The tower of Hanoi Problem	5	8
M4	**Trees:** Introduction to Tree as a data structure, Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals of Binary Search Trees), Threaded Binary Trees, Height-Balanced Trees (Various operations on AVL Trees)	8	14

M5	**Searching and Sorting:** Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Comparison of Sorting Techniques	7	10
M6	**Graphs:** Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth first search. Spanning Trees, minimum spanning Tree, Shortest path algorithm	8	15
M7	**Hashing:** Definition, Hashing functions, Load factor and collision, open addressing (linear probing) and chaining method to avoid collision	5	5
	INTERNAL EXAMINATION	3	30
TOTAL		51	100

List of Practical:

Practical No.	Practical Topic
1	Implementation of array operations.
2	Stacks and Queues: Adding and deleting elements.
3	Sparse Matrices: Multiplication, addition.
5	Implementation of linked lists: Inserting, deleting, and inverting a linked list.
6	Sorting and searching algorithms: Searching and sorting techniques.
7	Recursive and Non Recursive traversal of Trees, Threaded binary tree traversal. AVL tree implementation. Application of Trees.

Suggested Reading:

Suggested Reading No.	Book Title and Author(s)
1	*Data Structures Through C in Depth* by S. K. Srivastava and Deepali Srivastava - BPB Publications
2	*Data Structures Through C* by Yashavant Kanetkar - BPB Publications
3	*Data Structures: A Pseudocode Approach with C* by Richard F. Gilberg and Behrouz A. Forouzan (Adapted by Dinesh P. Mehta) - Cengage Learning India
4	*Data Structures and Algorithm Analysis in C* by Mark Allen Weiss (Adapted by Dinesh Mehta) - Pearson Education India
5	*Data Structures Using C and C++* by Tanenbaum - Pearson Education India
6	*Data Structures and Algorithms Made Easy* by M. S. Kutti Swamy - Pearson Education India

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PAPER: DATABASE MANAGEMENT SYSTEM (CODE: BSCITM302)
CREDIT: 3
PAPER CODE: BSCITM302
CONTACTS HOURS/ WEEK: 3L

Course Objective: After successful completion of this course, students will be able to:
To equip students with a comprehensive understanding of Database Management Systems (DBMS), including its architecture, data models, and the roles of a Database Administrator (DBA); to develop proficiency in designing and normalizing relational databases; to master Structured Query Language (SQL) for various database operations; to understand and implement transaction management, concurrency control, and database recovery techniques; and to gain practical skills in PL/SQL programming for developing efficient and secure database applications.

Course Outcome:	
CO1	Explain DBMS fundamentals, architecture, and DBA roles.
CO2	Illustrate relational and ER models, keys, constraints, and normalization.
CO3	Use SQL for data definition, manipulation, control, and complex queries.
CO4	Analyze transaction management, concurrency control, and recovery techniques.
CO5	Write and manage PL/SQL code for efficient database applications.

UNITS	**COURSE CONTENT**
1	**Basic Concept:(9L)** Database Management System, File based system, Advantages of DBMS over file based system, Database Approach, Logical DBMS Architecture, Three level architecture of DBMS or logical DBMS architecture, Need for three level architecture, Physical DBMS Architecture, Database Administrator (DBA) Functions & Role, Data files indices and Data Dictionary Types of Database, Relational and ER Models: Data Models, Relational Model, Domains, Tuple and Relation, Super keys, Candidate keys , Primary keys and foreign key for the Relations, Relational Constraints, Domain Constraint, Key Constraint, Integrity Constraint,- Update Operations and Dealing with Constraint Violations, Relational. Operations Entity Relationship (ER) Model: Entities, Attributes, Relationships, More about Entities and Relationships, Conversion of E-R Diagram to Relational Database.
2	**Database Integrity and Normalization:(8L)** Relational Database Integrity, The Keys, Referential Integrity, Entity Integrity, Redundancy and Associated Problems, Single Valued Dependencies, Normalization, Rules of Data Normalization, The First Normal Form, The Second Normal Form, The Third Normal Form, Boyce CODD Normal Form, Attribute Preservation, Lossless join Decomposition, Dependency Preservation.
3	**Structured Query Language (SQL):(9L)** Meaning, SQL commands, Data Definition Language, Data Manipulation Language, Data Control Language, Transaction Control Language, Queries using Order by, Where, Group by, Nested Queries. Joins, Views, Sequences, Indexes and Synonyms,

	Table Handling
4	**Transaction and Concurrency Management:(7L)** Transactions, Concurrent Transactions, Locking Protocol, Serializable Schedules, Locks Two Phase Locking (2PL), Deadlock and its Prevention, Optimistic& Pessimistic Concurrency Control. Database Recovery and Security: Database Recovery meaning, Kinds of failures, Failure controlling methods, Database errors, Backup & Recovery Techniques, Security & Integrity, Database Security Authorization
5	**PL/SQL:(7L)** Introduction to PL/SQL, Variables & Data types, Basic blocks, Conditional & branching statement, Handling of Cursor, Trigger, Function, Procedure, Package and Exception.

Reference Books:

- Silverchatz, Korth&Sudarshan-Data Base System Concepts, MH.
- Elmasri, Navathe- Fundamentals of Database Systems, Pearson
- C J date-An Introduction to Database, Addison-Wesley Publishing Company
- Majumder& Bhattacharyya-Data Base Management Systems, TMH
- Feuerstein-Oracle PL/SQL Programming,SPD/O'REILLY
- Leon-Data Base Management Systems, VIKAS
- Kroenke-Data Base Processing:Fundamentals, Design &Implementation,PHI
- P.S Deshpande-SQL PL/SQL for Oracle 8 & 8i, Wiley Dreamtech
- P. Bhatia, S. Bhatia, G. Singh- Concepts of Database Management System, Kalyani Publishers

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PAPER: DATABASE MANAGEMENT SYSTEM LAB (CODE: BSCITM392)
PAPER CODE: BSCITM392
Credit:2

Course Objective: After successful completion of this course, students will be able to:
To provide students with practical experience in managing and manipulating databases using SQL, covering essential operations from database creation to advanced querying and data modification, while ensuring data optimization and integrity through effective use of views, indexes, sequences, and constraints.

Course Outcome:	
CO1	Execute basic SQL commands for table creation, data insertion, and data retrieval.
CO2	Formulate advanced SQL queries to sort, group, and filter data using ORDER BY, GROUP BY, and HAVING clauses, and apply aggregate functions.
CO3	Perform complex data retrieval operations using different types of joins and nested queries, and utilize EXISTS and NOT EXISTS clauses.
CO4	Modify database structures and data by executing UPDATE, DELETE, and ALTER TABLE commands.
CO5	Optimize database performance by creating and managing views, indexes, and sequences, and ensure data integrity by defining and enforcing various constraints.

UNITS	**COURSE CONTENT**
1	Introduction and Basic SQL Commands: Creating tables with different data types. Inserting data into tables. Retrieving data using SELECT statements. Using WHERE clause for filtering data.
2	Advanced SQL Queries: Using ORDER BY clause for sorting data. Applying aggregate functions (SUM, AVG, COUNT, MAX, MIN). Grouping data using GROUP BY clause. Filtering grouped data using HAVING clause.
3	Joins and Subqueries: Performing different types of joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN). Writing nested queries (subqueries). Using EXISTS and NOT EXISTS clauses.
4	Database Modifications: Updating existing data with UPDATE statement. Deleting data using DELETE statement. Altering table structures (ALTER TABLE).
5	Database Optimization and Integrity: Creating and managing views. Defining and enforcing primary keys, foreign keys, and unique constraints. Implementing check constraints and default values.