Course Name: **MSc (CS/IT) 2nd Semester**

Subject Code: **CS-4209**

Subject Name: **Data Structures Using C++**

Aim of the Subject

To develop proficiency in the specification, representation, and implementation of Data Structures and apply the concepts for better program design.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Conceptual clarity of data structures and their operations.
- Exposure to write generic code expressing an algorithm.
- Proficiency in a way that may be used in a variety of real-world situations.

Unit 1

Introduction to C++ & Introduction to Data Structures:

C++ Basics, Introduction to Classes and Objects, Constructors, Destructors

Definition of Data Structures and Abstract Data Types (ADT). Classification of Data Structures, Static and Dynamic implementations. Operations on Data Structures, Examples and real life applications, Data Structures: Arrays, Address calculation in a single and multi dimensional array. Sparse matrices.

Unit 2

Stacks, Queues and Lists:

Definition, Array based implementation of Stacks, Linked List based implementation of Stacks, Examples: Infix, Postfix, Prefix representation, Applications: Mathematical expression evaluation, Linear Queue: Definition, Applications, Array based implementation of Queue, Linked List based implementation of Queue, Circular Queue, Double ended Queue (Dequeue), Priority queues, Singly linked Lists, Doubly linked List, Circular implementation of Singly linked list and Doubly linked List.

Unit 3

Trees & Graphs:

Definition of Tree and Binary Tree, Properties of Binary Tree, Types of Binary Tree, Tree Traversal - Preorder, Postorder, Inorder Traversal, Binary Search Tree and its Implementation, Threaded Tree, AVL Tree, Balanced multi way search trees- B-Tree, B+ Tree, Applications. Definition of Undirected and Directed Graphs and applications, representation of Graphs: Adjacency List, Adjacency Matrix, Linked List representation of graphs, Array based implementation of Graphs, Shortest path Algorithm, Graph Traversal: Breadth First Search Traversal, Depth First Search Traversal, Connectivity of Graphs; Connected components of graphs, Weighted Graphs and Applications.

Unit 4

Running time & Searching Algorithms:

Time Complexity, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity.

Sequential Search, Binary Search, non –recursive Algorithms, recursive Algorithms, Indexed Sequential Search. Hashing: Definition, Hash function, Collision Resolution Techniques, Hashing Applications.

Unit 5

Sorting Algorithms:

Introduction, Sorting by Exchange, Selection Sort, Insertion Sort, Bubble Sort, Selection Sort, Shell Sort, Merge sort, Merging of Sorted Arrays, Quick Sort Algorithm, Analysis of Quick sort, Picking a Pivot, A partitioning strategy, Heap sort, Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach, Radix sort.

Text Book(s)

1. Data Structures using C and C++ by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub, 6th Edition.

2. How to Program C++ by Paul Deitel , Harvey Deitel, Prentice Hall; 8 edition.

Reference Material(s)

1. Theory & Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline by TMH 2006,Special Indian Edition.

2. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Editi

Course Name: **MSc (CS/IT) 2nd Semester**

Subject Code: **CS-4405**

Subject Name: **Database Management System**

Aim of the Subject

The student should learn database design and information retrieval concepts and apply these concepts in complex projects involving large database.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Conceptual clarity on database systems and their evaluation
- theoretical foundation of query languages through relational algebra and relational calculus
- Database design issues from ER model to normalization
- proficiency in SQL, PLSQL & NoSQL through case studies
- exposure to advance topics like transaction management, concurrency control and physical data storage

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Unit 1

Introduction and Relational Model: Advantages of DBMS approach, various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator &user, data dictionary, database structure & architectures. Relational Model: Domains, relation, kind of relation, Relational databases, Various types of keys: candidate, primary, alternate & foreign keys, relational algebra with fundamental and extended operations, modification of database.

Unit 2

ER Model and SQL: Basic concept, design issues, mapping constraint, keys, ER diagram, weak& strong entity-sets, specialization & generalization, aggregation, inheritance, design of ER schema, Reduction of ER Schema to tables. SQL: Basic structure of SQL, Set operation, Aggregate functions, Null values, Nested Sub queries, derived relations, views, Modification of database, join relation, Domain, relation & keys, DDL in SQL. Programming concepts of PL/SQL, Stored procedure, Database connectivity with ODBC/JDBC 9. The concept of NoSQL, Brief history of NoSQL, SQL verses NoSQL, CAP Theorem (Brewer's Theorem), NoSQL pros/cons, Categories of NoSQL database, Production deployment, MongoDb, Key Features, practical with MongoDb.

Unit 3

Functional Dependencies: Basic definitions, Trivial & non trivial dependencies, closure set of dependencies & of attributes, Irreducible set of dependencies, FD diagram. Normalization: Introduction to normalization, non loss decomposition, First, second and third normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, join dependencies and fifth normal form.

Unit 4

Transaction Management: Basic concept, ACID properties, transaction state, Implementation of atomicity & durability, Concurrent execution, Basic idea of serializability. Concurrency & Recovery: Basic idea of concurrency control, the basic idea of deadlock, Failure Classification, storage structure-types, stable storage implementation, data access, recovery & Atomicity: log based recovery, deferred database modification, immediate database modification, checkpoints.

Unit 5

Database Integrity, Storage Structure & File Organization: general idea, integrity rules, Domain rules, Attributes rules, assertion, trigger, integrity & SQL. Storage Structure: overview of physical storage media, magnetic disk: performance & optimization, RAID. File Organization: File organization, Organization of records in files, the basic concept of Indexing, ordered indices: B+ tree & B tree index files.

Text Book(s)

1. Database System concepts –Henry F. Korth , Tata McGraw Hill 6th Edition.

Reference Material(s)

1. “Fundamentals of Database Systems”, Elmasri R, Navathe S, Addison Wesley 4th Ed.

2. An introduction to database system-Bipin C. Desai

3. An introduction to Database System -C.J Date

4. SQL, PL/SQL The programming language of Oracle-Ivan Bayross

Course Name: **MSc (CS/IT) 2nd Semester**

Subject Code: **CS-4305**

Subject Name: **Software Engineering**

Aim of the Subject

The course will help students to develop qualitative software product.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Application of software engineering approaches in software development.
- Ability to paln and estimate software projects.
- analysis ans design software as function oriented and Object Oriented Manner
- Pruduce quality software using testing and quality assurance mechanisms and
- approaches to software maintenance

Unit 1

Introduction to Software Engineering & Software Processes: Software, Software Classifications and Characteristics, Emergency of Software Engineering, What is Software Engineering? Software Engineering Challenges, Software Processes: Process model, Elements and Characteristics of Process model, Process Classification, Phased Development Life Cycle, Software Development Processes: Waterfall model, Iterative Waterfall model, Prototyping model, Incremental model and Spiral model.

Unit 2

Project Management & Planning: Project management essentials, Project success and failures, Project Life Cycle, Project team structure and organization. Project planning activities, Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques, Staffing and Personnel Planning, Project Scheduling and Miscellaneous Plans.

Unit 3

Requirement Engineering: Software Requirements, Requirement Engineering Process, Requirement Elicitation, Requirement Analysis (Structured Analysis, Object Oriented Analysis), Software Requirements Specification.

Unit 4

Software Design and Coding: Software Design Process, Characteristics of a Good Design, Design Principles, Modular Design, Software Architecture, Design Methodologies, Structured

Design Methodology (SDM), Coding principles, Coding process, Code verification and documentations.

Unit 5

Software Testing, Quality and Maintenance: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Debugging Approaches, Quality Concept, Quality Factors, Verification and Validation, Quality Assurance Activities, Software Maintenance.

Text Book(s)

1) Software Engineering: Concepts & Practices- Ugrasen Suman, Cengage Learning publications.

Reference Material(s)

1) Software Engineering Concepts – Richard Fairley, Tata McGraw-Hill International Edition.

2) An Integrated Approach to Software Engineering- Pankaj Jalote, Narosa Publishing House.

3) Software Engineering-A practitioner's approach- R. S. Pressman, Tat

Course Name: **MSc (CS/IT) 2nd Semester**

Subject Code: **CS-4008**

Subject Name: **Computer Architecture**

Aim of the Subject

To provide an understanding the functioning of the modern computer architecture, including mechanism of parallelism, pipelining and multiprocessor architecture through assembly language programming.

Learning Outcomes

The students are expected to learn following after completion of the course:

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Unit 1

Technological trends, measuring performance: MIPS, CPI/IPC, Benchmark suite, Geometric and Arithmetic means, Speed up, Amdahl's law. External Devices, I/O Modules, Programmed I/O, Interrupt driven I/O, Direct memory access. Functional units and components in computer organization: The memory unit, the input and output subsystem, the bus structures, design of ALU.

Unit 2

Processing unit design: Processor micro architecture –I, fundamentals concepts for data path implementation. Processor micro architecture-II, data path implementation. Concepts of instruction formats and instruction set, instruction set types, types of operands and operations. Generation of memory address and addressing modes.

Unit 3

STACKS and QUEUS, GPR based organization and stack based organizations. Encoding of machine instructions features of RISC and CISC processors.

Instruction pipelining: Instruction pipelining hazards, data dependency hazards and control hazards, overcoming hazards. Parallel processing and pipelining, pipelining in RISC and CISC processors.

Unit 4

Super scalar processors: in order and out of order execution, instruction level parallelism, introduction to VLIW processors, vector processors.

Cache Memory: Data caches, instruction caches and unified caches, cache implementations, fully associative and direct mapped caches, write back versus write through caches.

Unit 5

Multiprocessor Architectures: Introduction, architectures, Performance characteristics.

Multicore architectures: single chip Multiprocessors, Flynn classification, Interconnections

Structures, Interprocessors arbitration, Interprocessors Communication, Memory Organizations

in Multiprocessors, Shared Memory Multiprocessors System.

Synchronization: Memory Organization, Contention and Arbitration, Cache coherence

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Text Book(s)

1. Computer Architecture: Sachem's outlines by Dr. Rajkamal.

2. Computer Architecture and organization By William Stalling, Seventh edition

Reference Material(s)

1. Computer Architecture & Parallel Processing, Hwang & Briggs, McGraw Hill

2. Computer Architecture and Organization by D. A. Patterson

3. Computer Architecture: pipelined and parallel Processor Design by Michael J. Flynn, Jones & Bartlett Learning 19

Course Name: **MSc (CS/IT) 2nd Semester**

Subject Code: **IC-4915**

Subject Name: **Organization and Management Concepts**

Aim of the Subject

To make students understand the concepts of Management.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Identify the key management processes and the relevance of management in organizations.
- Understand the management skills required in organizations and how these might be applied.
- Evaluate their own managerial skills.

Unit 1

INTRODUCTION TO MANAGEMENT-

Definition of Management, Management Functions, Role of Managers, Principles of Management, Management Thought- Classical School, Systems Theory School

Unit 2

PLANNING-

Nature and purpose of planning - types of planning, planning process, Decision making

Unit 3

ORGANISING AND STAFFING-

Formal and Informal Organization, Basis of Departmentation, Span of Management, Line and Staff Conflicts, Definition of Staffing, Selection Process, Performance Appraisal, Career Strategy

Unit 4

MOTIVATION AND LEADERSHIP-

Motivation, Theories- Maslow's Need Hierarchy Theory, McGregor's Theory X and Theory Y, Herzberg's two factor theory, Leadership, Managerial grid

Unit 5