CMP 331.3 Data Structure and Algorithm (3 – 1 – 3)

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	80	-	100

Course Objectives:

1. To provide fundamental knowledge on data structure designing and implementation for strong information.
2. To provide the knowledge algorithms used in computer science .

Course Contents :

1. **Introduction of Data Structure** **(2hrs)**

Concept of data structure, Abstract data tpe, Implementation of data structure.

2. **The Stack** **(3hrs)**

Definition, Stack as an ADT, POP and PUSH operation, Stack application: Evaluation of Infix, Postix, and prefix expressions.

3. **Queue** **(3hrs)**

Definition, Queue as ADT, Primitive operations in queue, Linear and circular queue and their application, Enqueue and Dequenue, Priority queue.

4. **List** **(5hrs)**

Definition, Static and dynamic list structure, Array implementation of lists, Queues as list.

5. **Linked lists** **(5hrs)**

Definition and link list as an ADT, Dynamic implementation, Basic operations in linked list: node insertion, deletion, insertion and deletion after and before nodes, Linked stacks and Queues, Doubly linked lists and its advantages .

6. **Recursion** **(4hrs)**

Principle of recursion, Comparison between recursion and iteration, Recursion example, TOH and Fibonacci sequence, Applications of recursion, Search tree.

7. **Tree** **(5hrs)**

Concept and definitions, Basic operation in Binary tree, Tree search and insertion/deletions, Binary tree traversal (Preorder, Post-order and in-order), Tree height, level and depth, Balanced trees, AVL balanced trees, Balancing algorithm, The Huffman algorithm, game tree, B-Tree.

8. **Sorting** **(5hrs)**

Internal and external sort, Insertion and selection sort, Exchange sort, Bubble and quick sort Merge and Radix sort Shell sort, Binary sort, Heap sort as priority queue, Efficiency of sorting, Big 'O' notion.

9. **Searching** **(5hrs)**

Searching technique, essential of search, Sequential search, Binary search, Tree search, General search tree, Hashing: Hash function and hash tables, Collision resolution technique, Efficiency comparisons of different search technique.

10. **Graph** **(7hrs)**

Representation and applications, Graph as an ADT, Transitive closure, Warshall's algorithm, Graphs types, Graphs traversal and Spanning forest, Kruskal's and Round-Robin algorithms, Shortest-path algorithm, Greedy algorithm, Dijkstra's Algorithm.

11. **Algorithms** **(5hrs)**

Deterministic and no-deterministic algorithm, Divide and conquer algorithm, Series and parallel algorithm, Heuristic and Approximate algorithms.

Laboratory:

There shall be 10 lab exercises based on C or C++

1. Implementations of stack
2. Implementations of Liner and circular queues
3. Solutions of TOH and Fibonacci Recursion
4. Implementation of linked list: singly and doubly linked.
5. Implementation of trees: AVL trees, Balancing of VAL
6. Implementation of merge sort
7. Implementation of search: sequential, Tree and Binary
8. Implementation of Graphs: Graphs traversal
9. implementation of hashing
10. Implementation of Heap