

# Lovely Professional University, Punjab

| Course Code        | Course Title  | Course Planner   | Lectures | Tutorials | Practicals | Credits |
|--------------------|---|--|----------|-----------|------------|---------|
| CSE205             | DATA STRUCTURES AND ALGORITHMS  | 16915 :: Md. Ataullah  | 3        | 0         | 2          | 4       |
| Course Weightage   | ATT: 5   CA: 25   MTT: 20   ETT: 50   | Exam Category: 11: Mid Term Exam: All MCQ – End Term Exam: All MCQ |          |           |            |         |
| Course Orientation | COMPETITIVE EXAMINATION (Higher Education), KNOWLEDGE ENHANCEMENT, PLACEMENT EXAMINATION(Mass Recruiters) |  |          |           |            |         |

**Course Outcomes:** Through this course students should be able to

CO1 :: describe the process to find efficiency of algorithms using asymptotic notations.

CO2 :: develop skills to compare various data structure algorithms.

CO3 :: illustrate the importance of data structures in context of writing efficient programs.

CO4 :: identify appropriate data structures in problem solving.

CO5 :: recommend to improve existing code using learned algorithms and data structures.

CO6 :: construct new solutions for programming problems.

|       | TextBooks ( T )                |   |                       |
|-------|--------------------------------|---|-----------------------|
| Sr No | Title                          | Author  | Publisher Name        |
| T-1   | DATA STRUCTURES                | SEYMOUR LIPSCHUTZ                                     | MCGRAW HILL EDUCATION |
|       | Reference Books ( R )          |   |                       |
| Sr No | Title                          | Author  | Publisher Name        |
| R-1   | DATA STRUCTURES AND ALGORITHMS | ALFRED V. AHO, JEFFREY D. ULLMAN AND JOHN E. HOPCROFT | PEARSON               |

| Relevant Websites ( RW ) |   |  |
|--------------------------|---|--|
| Sr No                    | (Web address) (only if relevant to the course)  | Salient Features   |
| RW-1                     | <a href="https://www.geeksforgeeks.org/data-structures/">https://www.geeksforgeeks.org/data-structures/</a>   | Every data structure explained with the help of demo program                   |
| RW-2                     | <a href="http://www.cs.usfca.edu/~galles/visualization/Algorithms.html">http://www.cs.usfca.edu/~galles/visualization/Algorithms.html</a>             | Data structures visualization  |
| RW-3                     | <a href="https://www.tutorialspoint.com/data_structures_algorithms/index.htm">https://www.tutorialspoint.com/data_structures_algorithms/index.htm</a> | Tutorials give a clear understanding of concepts in easy and simplified manner |
| RW-4                     | <a href="http://www.cs.auckland.ac.nz/software/AlgAnim/huffman.html">http://www.cs.auckland.ac.nz/software/AlgAnim/huffman.html</a>                   | Huffman Encoding   |

| Audio Visual Aids ( AV ) |   |                                       |
|--------------------------|---|---------------------------------------|
| Sr No                    | (AV aids) (only if relevant to the course)  | Salient Features                      |
| AV-1                     | <a href="https://freevideolectures.com/subject/data-structures/">https://freevideolectures.com/subject/data-structures/</a> | Data structures audio video tutorials |

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| Software/Equipments/Databases |  |   |
|-------------------------------|--|---|
| Sr No                         | (S/E/D) (only if relevant to the course) | Salient Features  |
| SW-1                          | Dev C++ /Borland C++/Turbo C++           | IDE to implement data structures in convenient and faster way |

| LTP week distribution: (LTP Weeks) |   |
|------------------------------------|---|
| Weeks before MTE                   | 7 |
| Weeks After MTE                    | 7 |
| Spill Over (Lecture)               | 9 |

### Detailed Plan For Lectures

| Week Number | Lecture Number          | Broad Topic(Sub Topic)                          | Chapters/Sections of Text/reference books | Other Readings, Relevant Websites, Audio Visual Aids, software and Virtual Labs | Lecture Description   | Learning Outcomes  | Pedagogical Tool Demonstration/ Case Study / Images / animation / ppt etc. Planned | Live Examples                                  |
|-------------|-------------------------|---|---|---|---|--|--|--|
| Week 1      | Lecture/<br>Practical 1 | Basic Data Structures                           | T-1, R-1                                  | RW-1, RW-3  | Lecture 0, Introduction to data structures                                  | Remembering basic concepts and algorithmic notations used in data structures, complexity of algorithms | Lecture cum demonstration, brain storming  | Keeping files in a folder, directory structure |
|             | Lecture/<br>Practical 2 | Complexity analysis: time space and trade off,  | T-1, R-1                                  | RW-1, RW-3  | Applications of different types of data structures and time space trade off | Understanding how to apply suitable data structure for given application                               | Lecture cum demonstration, brain storming  | Moves on chess board                           |
|             | Lecture/<br>Practical 3 | Omega Notation, Theta Notation, BigO notation   | T-1, R-1                                  | RW-1, RW-3  | Applications of different types of data structures and time space trade off | Understanding how to apply suitable data structure for given application                               | Lecture cum demonstration, brain storming  | Moves on chess board                           |
|             | Lecture/<br>Practical 4 | Linear arrays: memory representation, Traversal | T-1, R-1                                  | RW-1, RW-3, SW-1  | Traversal operation in arrays   | Understanding manipulation of elements in an array   | Lecture cum demonstration, brain storming  | Placing a chair in between a row of chairs     |
|             | Lecture/<br>Practical 5 | Linear arrays: Insertion, Deletion              | T-1, R-1                                  | RW-1, SW-1  | Insertion operation in arrays   | Understanding manipulation of elements in an array   | Lecture cum demonstration, brain storming  | Placing a chair in between a row of chairs     |

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|        |                          |  |          |                     |   |  |   |   |
|--------|--------------------------|--|----------|---------------------|---|--|---|---|
| Week 2 | Lecture/<br>Practical 6  | Linear arrays:<br>Insertion,<br>Deletion                   | T-1, R-1 | RW-1, SW-1          | Deletion operation in<br>arrays                                 | Understanding<br>manipulation of<br>elements in an<br>array                          | Lecture cum<br>demonstration,<br>brain storming | Removing a<br>chair in<br>between a<br>row of chairs            |
|        | Lecture/<br>Practical 7  | Searching and its<br>complexity<br>analysis.               | T-1, R-1 | RW-1, RW-<br>2,SW-1 | Searching (linear<br>search, binary search)<br>element in array | Analyzing how to<br>apply appropriate<br>searching algorithm<br>at appropriate place | Lecture cum<br>demonstration,<br>brain storming | Searching a<br>person sitting<br>in a row of<br>chairs          |
|        | Lecture/<br>Practical 8  | Searching and its<br>complexity<br>analysis.               | T-1, R-1 | RW-1, RW-<br>2,SW-1 | Searching (linear<br>search, binary search)<br>element in array | Analyzing how to<br>apply appropriate<br>searching algorithm<br>at appropriate place | Lecture cum<br>demonstration,<br>brain storming | Searching a<br>person sitting<br>in a row of<br>chairs          |
|        | Lecture/<br>Practical 9  | Merging and its<br>complexity<br>analysis.                 | T-1, R-1 | RW-1, RW-<br>2,SW-1 | Merging elements of<br>arrays                                   | Understanding<br>manipulation of<br>elements in an<br>array                          | Lecture cum<br>demonstration,<br>brain storming | Merging two<br>sections of a<br>class for<br>giving lecture     |
|        | Lecture/<br>Practical 10 | Bubble sort,<br>Insertionsort,<br>Selection sort           | T-1, R-1 | RW-1, RW-<br>2,SW-1 | Sorting elements of<br>array                                    | Analyzing how to<br>apply appropriate<br>sorting algorithm<br>at appropriate place   | Lecture cum<br>demonstration,<br>brain storming | Making<br>students sit<br>according to<br>roll-nos. in a<br>row |
| Week 3 | Lecture/<br>Practical 11 | Bubble sort,<br>Insertion sort,<br>Selection sort          | T-1, R-1 | RW-1, RW-<br>2,SW-1 | Sorting elements of<br>array                                    | Analyzing how to<br>apply appropriate<br>sorting algorithm<br>at appropriate place   | Lecture cum<br>demonstration,<br>brain storming | Making<br>students sit<br>according to<br>roll-nos. in a<br>row |
|        | Lecture/<br>Practical 12 | Linked Lists:<br>Introduction,<br>Memory<br>representation | T-1, R-1 | RW-1, RW-<br>3,SW-1 | Introduction to linked<br>list and its creation                 | Understanding<br>linked<br>representation of<br>memory and<br>dynamic allocation     | Lecture cum<br>demonstration,<br>brain storming | Chain, slides<br>management<br>in<br>presentation.              |
|        | Lecture/<br>Practical 13 | Linked Lists:<br>Allocation,<br>Traversal                  | T-1, R-1 | RW-1, RW-<br>3,SW-1 | Introduction to linked<br>list and its creation                 | Understanding<br>linked<br>representation of<br>memory and<br>dynamic allocation     | Lecture cum<br>demonstration,<br>brain storming | Chain, slides<br>management<br>in<br>presentation.              |
|        | Lecture/<br>Practical 14 | Linked Lists:<br>Insertion                                 | T-1, R-1 | RW-1, SW-1          | Introduction to linked<br>list and its creation                 | Understanding<br>linked<br>representation of<br>memory and<br>dynamic allocation     | Lecture cum<br>demonstration,<br>brain storming | Chain, slides<br>management<br>in<br>presentation.              |
|        | Lecture/<br>Practical 15 | Linked Lists:<br>Insertion                                 | T-1, R-1 | RW-1, SW-1          | Introduction to linked<br>list and its creation                 | Understanding<br>linked<br>representation of<br>memory and<br>dynamic allocation     | Lecture cum<br>demonstration,<br>brain storming | Chain, slides<br>management<br>in<br>presentation.              |

|        |                          |   |          |                  |   |   |   |  |
|--------|--------------------------|---|----------|------------------|---|---|---|--|
| Week 4 | Lecture/<br>Practical 16 | Linked Lists:<br>Deletion   | T-1, R-1 | RW-1, SW-1       | Algorithm to traverse and delete nodes in linked list                   | Understanding linked representation of memory and dynamic allocation                      | Lecture cum demonstration, brain storming | Chain, slides management in presentation.    |
|        | Lecture/<br>Practical 17 | Linked Lists:<br>Deletion   | T-1, R-1 | RW-1, SW-1       | Algorithm to traverse and delete nodes in linked list                   | Understanding linked representation of memory and dynamic allocation                      | Lecture cum demonstration, brain storming | Chain, slides management in presentation.    |
|        | Lecture/<br>Practical 18 | Header linked lists: Grounded and Circular  | T-1, R-1 | RW-1, SW-1       | Different variant of linked list  | Analyzing modification in the design of linked list to increase efficiency                | Lecture cum demonstration, brain storming | Arrangement of coaches of a train            |
|        | Lecture/<br>Practical 19 | Header linked lists: Grounded and Circular  | T-1, R-1 | RW-1, SW-1       | Different variant of linked list  | Analyzing modification in the design of linked list to increase efficiency                | Lecture cum demonstration, brain storming | Arrangement of coaches of a train            |
|        | Lecture/<br>Practical 20 | Header linked lists: Grounded and Circular  | T-1, R-1 | RW-1, SW-1       | Different variant of linked list  | Analyzing modification in the design of linked list to increase efficiency                | Lecture cum demonstration, brain storming | Arrangement of coaches of a train            |
| Week 5 | Lecture/<br>Practical 21 | Two-way lists: operations on two-way linked lists   | T-1, R-1 | RW-1, SW-1       | Different variant of linked list  | Analyzing modification in the design of linked list to increase efficiency                | Lecture cum demonstration, brain storming | Arrangement of coaches of a train            |
|        | Lecture/<br>Practical 22 | Two-way lists: operations on two-way linked lists   | T-1, R-1 | RW-1, SW-1       | Different variant of linked list  | Analyzing modification in the design of linked list to increase efficiency                | Lecture cum demonstration, brain storming | Arrangement of coaches of a train            |
|        | Lecture/<br>Practical 23 |   |          |                  | Online Assignment   |   |   |  |
|        | Lecture/<br>Practical 24 | Stacks: Introduction: List and Array representations, Operations on stack (traversal, push and pop) | T-1, R-1 | RW-1, RW-2, SW-1 | Representing stack using linked list and array, push and pop operations | Understanding implementation of stack using array and linked list as per LIFO arrangement | Lecture cum demonstration, brain storming | Navigation of directory structure in windows |
|        | Lecture/<br>Practical 25 | Stacks: Introduction: List and Array representations, Operations on stack                           | T-1, R-1 | RW-1, RW-2, SW-1 | Representing stack using linked list and array, push and pop operations | Understanding implementation of stack using array and linked list as per LIFO arrangement | Lecture cum demonstration, brain storming | Navigation of directory structure in windows |

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|        |                          |   |          |                 |  |  |   |  |
|--------|--------------------------|---|----------|-----------------|--|--|---|--|
|        |                          | (traversal, push and pop)   |          |                 |  |  |   |  |
| Week 6 | Lecture/<br>Practical 26 | Stacks:<br>Introduction:List and Array representations, Operations on stack (traversal, push and pop) | T-1, R-1 | RW-1, RW-2,SW-1 | Representing stack using linked list and array, push and pop operations  | Understanding implementation of stack using array andlinked list as per LIFO arrangement | Lecture cum demonstration, brain storming | Navigation of directory structure in windows |
|        | Lecture/<br>Practical 27 | Arithmetic expressions: polishnotation  | T-1, R-1 | RW-1, SW-1      | Stack representation of arithmetic expressions expression using stack    | Understanding prefix, infix and postfix notations preparation                            | Lecture cum demonstration, brain storming | Compiler design                              |
|        | Lecture/<br>Practical 28 | Evaluation and transformation of expressions  | T-1, R-1 | RW-1, SW-1      | Evaluation and transformation of infix to postfix expression using stack | Understanding evaluation and transformation of infix to postfix expression using stack   | Lecture cum demonstration, brain storming | Compiler design                              |
|        | Lecture/<br>Practical 29 | Queue: Array and listrepresentation, operations (traversal, insertion anddeletion)                    | T-1, R-1 | RW-1, RW-2,SW-1 | Representation of queue using arrays and linked list and operations      | Understanding memory management as per FIFO arrangement                                  | Lecture cum demonstration, brain storming | Process scheduling algorithms                |
|        | Lecture/<br>Practical 30 | Queue: Array and listrepresentation, operations (traversal, insertion and deletion)                   | T-1, R-1 | RW-1, RW-2,SW-1 | Representation of queue using arrays and linked list and operations      | Understanding memory management as per FIFO arrangement                                  | Lecture cum demonstration, brain storming | Process scheduling algorithms                |
| Week 7 | Lecture/<br>Practical 31 | Queue: Array and listrepresentation, operations (traversal, insertion and deletion)                   | T-1, R-1 | RW-1, RW-2,SW-1 | Representation of queue using arrays and linked list and operations      | Understanding memory management as per FIFO arrangement                                  | Lecture cum demonstration, brain storming | Process scheduling algorithms                |
|        | Lecture/<br>Practical 32 | Priority Queues   | T-1, R-1 | RW-1, SW-1      | Different versions of queue and its operations                           | Understanding memory management as per FIFO arrangement                                  | Lecture cum demonstration, brain storming | Process scheduling algorithms                |
|        | Lecture/<br>Practical 33 | Deque   | T-1, R-1 | RW-1, SW-1      | Different versions of queue and its operations                           | Understanding memory management as per FIFO arrangement                                  | Lecture cum demonstration, brain storming | Process scheduling algorithms                |

## SPILL OVER

|                 |                          |   |          |            |   |   |   |   |
|-----------------|--------------------------|---|----------|------------|---|---|---|---|
|                 | Lecture/<br>Practical 34 |   |          | AV-1       | Spill Over  |   |   |   |
|                 | Lecture/<br>Practical 35 |   |          | AV-1       | Spill Over  |   |   |   |
| <b>MID-TERM</b> |                          |   |          |            |   |   |   |   |
| Week 8          | Lecture/<br>Practical 36 | Recursion:<br>Introduction,<br>Recursive<br>implementation of<br>Towers of Hanoi  | T-1, R-1 | RW-1, SW-1 | Introduction of<br>recursion and problem<br>of tower of Hanoi           | Using recursive<br>solutions for<br>different problems                  | Lecture cum<br>demonstration,<br>brain storming | Container<br>loading and<br>unloading                                       |
|                 | Lecture/<br>Practical 37 | Recursion: Merge<br>sort  | T-1, R-1 | RW-1, SW-1 | Algorithm of merge<br>sort using recursive<br>method                    | Using recursive<br>solutions for<br>different problems                  | Lecture cum<br>demonstration,<br>brain storming |   |
|                 | Lecture/<br>Practical 38 | Recursion: Merge<br>sort  | T-1, R-1 | RW-1, SW-1 | Algorithm of merge<br>sort using recursive<br>method                    | Using recursive<br>solutions for<br>different problems                  | Lecture cum<br>demonstration,<br>brain storming |   |
|                 | Lecture/<br>Practical 39 | Recursion: Quick<br>sort  | T-1, R-1 | RW-1, SW-1 | Algorithm of Quick<br>sort using recursive<br>method                    | Using recursive<br>solutions for<br>different problems                  | Lecture cum<br>demonstration,<br>brain storming |   |
|                 | Lecture/<br>Practical 40 | Recursion: Quick<br>sort  | T-1, R-1 | RW-1, SW-1 | Algorithm of Quick<br>sort using recursive<br>method                    | Using recursive<br>solutions for<br>different problems                  | Lecture cum<br>demonstration,<br>brain storming |   |
| Week 9          | Lecture/<br>Practical 41 | Trees: Binary trees<br>- introduction<br>(complete and<br>extended binary<br>trees), memory<br>representation<br>(linked, sequential) | T-1, R-1 | RW-1, SW-1 | Introduction to tree<br>data structure and its<br>memory representation | Remembering<br>nonlinear memory<br>arrangements and<br>its applications | Lecture cum<br>demonstration,<br>brain storming | Directory<br>structure and<br>file system,<br>Web site<br>link<br>structure |
|                 | Lecture/<br>Practical 42 | Trees : Binary trees<br>-introduction<br>(complete and<br>extended binary<br>trees), memory<br>representation<br>(linked, sequential) | T-1, R-1 | RW-1, SW-1 | Introduction to tree<br>data structure and its<br>memory representation | Remembering<br>nonlinear memory<br>arrangements and<br>its applications | Lecture cum<br>demonstration,<br>brain storming | Directory<br>structure and<br>file system,<br>Web site<br>link<br>structure |
|                 | Lecture/<br>Practical 43 | Trees: Pre-order<br>traversal, In-order<br>traversal, Post-<br>ordertraversal<br>using recursion                                      | T-1, R-1 | RW-1, SW-1 | Tree traversal basics<br>and pre-order tree<br>traversal algorithm      | Understanding<br>node to node access                                    | Lecture cum<br>demonstration,<br>brain storming | Directory<br>structure and<br>file system,<br>Web site<br>link<br>structure |

|         |                          |  |          |                  |   |   |   |  |
|---------|--------------------------|--|----------|------------------|---|---|---|--|
|         | Lecture/<br>Practical 44 | Trees: Pre-order traversal, In-order traversal, Post-order traversal using recursion | T-1, R-1 | RW-1, SW-1       | Tree traversal basics and pre-order tree traversal algorithm      | Understanding node to node access   | Lecture cum demonstration, brain storming | Directory structure and file system, Web site link structure |
|         | Lecture/<br>Practical 45 | Binary Search Tree-insertion   | T-1, R-1 | RW-1, RW-2, SW-1 | Introduction to binary search tree                                | Understanding arrangement of data efficiently   | Lecture cum demonstration, brain storming | Directory structure and file system, Web site link structure |
| Week 10 | Lecture/<br>Practical 46 | Binary Search Tree-searching,  | T-1, R-1 | RW-1, RW-2, SW-1 | Insertion of nodes and its algorithm in binary search tree        | Understanding arrangements of data after manipulations  | Lecture cum demonstration, brain storming | Directory structure and file system, Web site link structure |
|         | Lecture/<br>Practical 47 | Binary Search Tree-deletion  | T-1, R-1 | RW-1, RW-2, SW-1 | Deletion of nodes and its algorithm in binary search tree         | Understanding arrangements of data after manipulations  | Lecture cum demonstration, brain storming | Directory structure and file system, Web site link structure |
|         | Lecture/<br>Practical 48 |  |          |                  | Online Assignment   |   |   |  |
|         | Lecture/<br>Practical 49 | AVL trees - introduction   | T-1, R-1 | RW-1, RW-2, SW-1 | Introduction to AVL trees and insertion                           | Applying another requirement to make more efficient arrangement of data in nonlinear data structure | Lecture cum demonstration, brain storming |  |
|         | Lecture/<br>Practical 50 | AVL trees Insertion  | T-1, R-1 | RW-1, RW-2, SW-1 | Introduction to AVL trees and insertion                           | Applying another requirement to make more efficient arrangement of data in nonlinear data structure | Lecture cum demonstration, brain storming |  |
|         |                          |  |          |                  |   |   |   |  |
| Week 11 | Lecture/<br>Practical 51 | AVL trees Deletion   | T-1, R-1 | RW-1, RW-2, SW-1 | Deletion in AVL tree  | Applying another requirement to make more efficient arrangement of data in nonlinear data structure | Lecture cum demonstration, brain storming |  |
|         | Lecture/<br>Practical 52 | Heaps - Insertion, Heapify   | T-1, R-1 | RW-1, RW-2, SW-1 | Introduction to heap, insertion and deletion algorithm, Heap sort | Understanding array representation of trees   | Lecture cum demonstration, brain storming |  |

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|         |                          |   |          |                     |   |  |   |  |
|---------|--------------------------|---|----------|---------------------|---|--|---|--|
|         | Lecture/<br>Practical 53 | Heaps - Insertion,<br>Heapify   | T-1, R-1 | RW-1, RW-2,<br>SW-1 | Introduction to heap,<br>insertion and deletion<br>algorithm, Heap sort | Understanding array<br>representation of<br>trees                  | Lecture cum<br>demonstration,<br>brain storming |  |
|         | Lecture/<br>Practical 54 | Heaps - Deletion  | T-1, R-1 | RW-1, RW-2,<br>SW-1 | Introduction to heap,<br>insertion and deletion<br>algorithm, Heap sort | Understanding array<br>representation of<br>trees                  | Lecture cum<br>demonstration,<br>brain storming |  |
|         | Lecture/<br>Practical 55 | Heaps - Heap Sort   | T-1, R-1 | RW-1, RW-2,<br>SW-1 | Introduction to heap,<br>insertion and deletion<br>algorithm, Heap sort | Applying array<br>representation of<br>trees                       | Lecture cum<br>demonstration,<br>brain storming |  |
| Week 12 | Lecture/<br>Practical 56 | Huffman algorithm   | T-1, R-1 | RW-4                | Compression algorithm<br>for different strings                          | Applying technique<br>for efficient use of<br>resources to arrange | Lecture cum<br>demonstration,<br>brain storming | Compression<br>in Fax<br>machine                   |
|         | Lecture/<br>Practical 57 | Huffman algorithm   | T-1, R-1 | RW-4                | Compression algorithm<br>for different strings                          | Applying technique<br>for efficient use of<br>resources to arrange | Lecture cum<br>demonstration,<br>brain storming | Compression<br>in Fax<br>machine                   |
|         | Lecture/<br>Practical 58 | Graphs:<br>Warshall's<br>algorithm  | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
|         | Lecture/<br>Practical 59 | Graphs:<br>Warshall's<br>algorithm  | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
|         | Lecture/<br>Practical 60 | Shortest path<br>algorithm: Floyd<br>Warshall<br>Algorithm<br>(modified<br>Warshall<br>algorithm) | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
| Week 13 | Lecture/<br>Practical 61 | Shortest path<br>algorithm: Floyd<br>Warshall<br>Algorithm<br>(modified<br>Warshall<br>algorithm) | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
|         | Lecture/<br>Practical 62 | Graph<br>Traversal:BFS,<br>DFS  | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
|         | Lecture/<br>Practical 63 | Graph<br>Traversal:BFS,<br>DFS  | T-1, R-1 | RW-1, SW-1          | Operations on graphs<br>and shortest path<br>algorithm                  | Understanding node<br>to node movement<br>within graphs            | Lecture cum<br>demonstration,<br>brain storming | Maps and<br>Navigation                             |
|         | Lecture/<br>Practical 64 |   |          |                     | Online Assignment   |  |   |  |
|         | Lecture/<br>Practical 65 | Hashing : Hashing<br>Introduction, Hash<br>Functions, Hash<br>Table                               | T-1, R-1 | RW-1                | Hashing techniques<br>and collision detection                           | Applying<br>efficient searching                                    | Lecture cum<br>demonstration,<br>brain storming | Dictionary<br>lookup and<br>security<br>algorithms |

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|         |                          |   |          |      |   |                                 |   |  |
|---------|--------------------------|---|----------|------|---|---------------------------------|---|--|
| Week 14 | Lecture/<br>Practical 66 | Closed hashing<br>(openaddressing)                        | T-1, R-1 | RW-1 | Hashing techniques<br>and collision detection | Applying<br>efficient searching | Lecture cum<br>demonstration,<br>brain storming | Dictionary<br>lookup and<br>security<br>algorithms |
|         | Lecture/<br>Practical 67 | Linear Probing,<br>Quadratic<br>Probing,Double<br>Hashing | T-1, R-1 | RW-1 | Hashing techniques<br>and collision detection | Applying<br>efficient searching | Lecture cum<br>demonstration,<br>brain storming | Dictionary<br>lookup and<br>security<br>algorithms |
|         | Lecture/<br>Practical 68 | Open hashing<br>(separate<br>chaining)                    | T-1, R-1 | RW-1 | Hashing techniques<br>and collision detection | Applying<br>efficient searching | Lecture cum<br>demonstration,<br>brain storming | Dictionary<br>lookup and<br>security<br>algorithms |

## SPILL OVER

|         |                          |  |  |      |            |  |  |  |
|---------|--------------------------|--|--|------|------------|--|--|--|
|         | Lecture/<br>Practical 69 |  |  | AV-1 | Spill Over |  |  |  |
|         | Lecture/<br>Practical 70 |  |  | AV-1 | Spill Over |  |  |  |
| Week 15 | Lecture/<br>Practical 71 |  |  | AV-1 | Spill Over |  |  |  |
|         | Lecture/<br>Practical 72 |  |  | AV-1 | Spill Over |  |  |  |
|         | Lecture/<br>Practical 73 |  |  | AV-1 | Spill Over |  |  |  |
|         | Lecture/<br>Practical 74 |  |  | AV-1 | Spill Over |  |  |  |
|         | Lecture/<br>Practical 75 |  |  | AV-1 | Spill Over |  |  |  |

Scheme for CA:

CA Category of this Course Code is: A0203 (2 best out of 3)

| Component         | Weightage (%) |
|-------------------|---------------|
| Online Assignment | 50            |
| Online Assignment | 50            |
| Online Assignment | 50            |

Details of Academic Task(s)

| Academic Task     | Objective   | Detail of Academic Task   | Nature of Academic Task | Mode of Academic Task | Marks | Allotment week/Submission Week |
|-------------------|---|---|-------------------------|-----------------------|-------|--------------------------------|
| Online Assignment | To evaluate progress of individual student based upon basic data structures implementation and complexity | Multiple choice questions with mix of analytic and descriptive type as per the contents delivered | Individual              | Online                | 30    | Week 4/Week 5                  |
| Online Assignment | To evaluate progress of individual student based upon applicability of learned concepts                   | Multiple choice questions with mix of analytic and descriptive type as per the contents delivered | Individual              | Online                | 30    | Week 9/Week 10                 |
| Online Assignment | To evaluate progress of individual student based upon applicability of learned concepts                   | Multiple choice questions with mix of analytic and descriptive type as per the contents delivered | Individual              | Online                | 30    | Week 12/Week 13                |