Savitribai Phule Pune University, Pune

*Faculty of Commerce and Management*

Master of Computer Application (MCA)

*Programme Curriculum (2020-2022)*

### Evaluation and Assessment:

In total 112 credits represent the workload of a year for MCA program.

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| --- | --- | --- | --- |
| **Semester** | **Credit** | **IE** | **UE** |
| Semester I | 28 | 350 | 350 |
| Semester II | 28 | 350 | 350 |
| Semester III | 28 | 350 | 350 |
| Semester IV | 28 | 350 | 350 |
| **Total** | **112** | **1400** | **1400** |
|  | | | **2800** |

The final total assessment of the candidate is made in terms of an internal (concurrent) evaluation and an external (university) examination for each course. In total the internal (concurrent) to external (university) marks ratio is maintained 50:50.

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| --- | --- | --- | --- | --- | --- |
| **Semester I** | | | | | |
| **Sr. No.** | **Course Title** | **Course Code** | **CP** | **EXT** | **INT** |
| 1 | Java Programming | IT11 | 3 | 50 | 25 |
| 2 | Data Structure and Algorithms | IT12 | 3 | 50 | 25 |
| 3 | Object Oriented Software Engineering | IT13 | 3 | 50 | 25 |
| 4 | Operating System Concepts | IT14 | 3 | 50 | 25 |
| 5 | Network Technologies | IT15 | 3 | 50 | 25 |
| 6 | Open Course 1 | OC11 | 1 |  | 25 |
| 7 | Open Course 2 | OC12 | 1 |  | 25 |
| **\* Practicals** | | | | | |
| 8 | Practical | IT11L | 5 | 50 | 75 |
| 9 | Mini Project | ITC11 | 5 | 50 | 75 |
| **Soft Skills** | | | | | |
| 10 | Soft Skills - I | SS11 | 1 |  | 25 |
|  |  |  | **28** | **350** | **350** |

# Course Code: IT-12

Course Name: Data Structure and Algorithms

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| **Credit Scheme** | | | **Evaluation Scheme** | | | | |
| **Lecture** | **Practical** | **Credit** | **Internal** | | | External | Total |
|  |  |  | **Written** | **Practical** | **Tutorial** |  |  |
| 3 Hrs./Week | - | 3 | 25 | - | - | 50 | 75 |

## Course Description:

#### Prerequisite

Loops*,* Functions, Pointers, Arrays, Memory Allocation, Recursion

#### Course Objectives:

1. To understand basics data structure and algorithms
2. To solve problems using data structures such as linked lists, stacks, queues, hash tables, trees, heaps and graphs
3. To understand various programming techniques such as brute force, greedy, dynamic programming, divide-conquer and backtracking

#### Course Outcomes:

Student will be able to

CO1: demonstrate linear data structures linked list, stack and queue (apply) CO2: implement tree, graph, hash table and heap data structures (apply) CO3: apply brute force and backtracking techniques (apply)

CO4: demonstrate greedy and divide-conquer approaches (apply) CO5: implement dynamic programming technique (apply)

#### Course Structure:

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| --- | --- | --- | --- |
| **Sr. No.** | **Topics Details** | **Weightage in %** | **No of Sessions** |
| **1** | **Linked List**   * 1. Singly Linked List   2. Doubly Linked List   Extra Reading: Circular Linked list and Circular doubly linked list | 8 | 2 |
| 2 | **Stack and Queues**   * 1. Linked List implementation of Stack   2. Linked List implementation of Queue   3. Circular Queue | 10 | 4 |

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|  | 2.4 Priority Queue  Extra Reading: Dqueue, Application of Stack |  |  |
| 3 | **Tree**   * 1. Tree   2. Binary Search Tree   3. AVL Tree   4. Red-Black Tree   5. Segment Tree - with min/max/sum range queries   examples   * 1. Fenwick Tree (Binary Indexed Tree)   Extra Reading: Application of Tree, B\* tree | 12 | 5 |
| 4 | **Graph**   * 1. Directed and Undirected Graph   2. Graph Representations      1. Adjacency Matrix      2. Adjacency List   3. Graph Traversals      1. BFS      2. DFS   Extra Reading: Application of Graph in Maps | 8 | 2 |
| 5 | **Hash Table and Heaps**   * 1. Hash Table      1. Hash Function      2. Hash function approaches      3. Handling the collisions   2. Heap      1. Min heap and Max heap   Extra Reading: Hashing used in File handling | 7 | 2 |
| 6 | **Brute Force**   * 1. Linear Search   2. Rain Terraces   3. Recursive Staircase   4. Maximum Subarray   5. Travelling Salesman Problem   6. Discrete Fourier Transform   Extra Reading: Application in Cryptography | 10 | 5 |
| 7 | **Greedy**   * 1. Jump Game   2. Unbound Knapsack Problem   3. Dijkstra Algorithm   4. Prim’s Algorithm | 10 | 5 |

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|  | 7.5 Kruskal’s Algorithm  Extra Reading: Huffman’s Tree |  |  |
| 8 | **Divide and Conquer**   * 1. Binary Search   2. Tower of Hanoi   3. Pascal's Triangle   4. Euclidean Algorithm   5. Merge Sort   6. Quicksort   7. Fast Powering   Extra Reading: Cooley–Tukey Fast Fourier Transform (FFT) algorithm | 10 | 8 |
| 9 | **Dynamic Programming**   * 1. Fibonacci Number   2. Unique Paths   3. Longest Common Subsequence (LCS)   4. Longest Common Substring   5. Longest Increasing Subsequence   6. Shortest Common Super sequence   7. 0/1 Knapsack Problem   8. Integer Partition   9. Regular Expression Matching   Extra Reading: Painting Fence Algorithm, Moser-de Bruijn Sequence, Newman-Conway Sequence | 15 | 7 |
| 10 | **Backtracking**   * 1. Power Set   2. Hamiltonian Cycle   3. N-Queens Problem   4. Knight's Tour   5. Combination Sum   Extra Reading: Word Break Problem using Backtracking | 10 | 5 |
| **Total:** | | **100** | **45** |
| **Note: Course should be taught independent of any programming**  **language.** | | | |

*Course References:*

##### Recommended Books:

Text Books

* 1. Jean Paul Tremblay, Paul G. Sorensons, “AN Introduction to Data Structures with Application”, McGraw Hall Publication (INDIAN edition)
  2. A. V. Aho and J.D. Ullman, “Design and Analysis of Algorithms”, Addison Wesley
  3. Thomas H Cormen and Charles E.L Leiserson, “Introduction to Algorithm” PHI Reference Books

1. Lipschutz Schaum’s, “Data Structure”, Outline Series, MH
2. D. Samanta, “Classical Data Structure”, PHI,
3. Practical Approach to Data Structures by Hanumanthappa.
4. Data Structure and Algorithms in C++ by Joshi Brijendra Kumar
5. Data Structures with C++: Schaum’s Outlines by Hubbard JohnBressard,
6. Horowitz/Sahani, Fundamental of Algorithm. PHI, Galgotia.
7. Magnifying Data Structures, Arpita Gopal, PHI Publications

# Course Code: IT-11L Course Name: Practicals

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| **Credit Scheme** | | | **Evaluation Scheme** | | | | |
| **Lecture** | **Practical** | **Credit** | **Internal** | | | External | Total |
|  |  |  | **Written** | **Practical** | **Tutorial** |  |  |
| - | 10 Hrs./Week | 5 | - | 75 | - | 50 | 125 |

## Course Description:

This Practical course contains 3 sections. –

1. JavaScript Syllabus
2. List of Practicals – Java Programming
3. List of Practicals – Data Structure and Algorithm

#### Course Outcomes:

Student will be able to

CO1: Demonstrate Collection framework (Apply) CO2: Develop GUI using awt and swing (Apply)

CO3: Develop Web application using JSP and Servlet, JDBC (Apply) CO4: Apply Data Structure to solve problems using JavaScript (Apply)

List of Practicals – Data Structure and Algorithm Practicals

**Following practical must be implemented using JavaScript**

1. Demonstrate singly and doubly linked list
2. STACK implementation using Array with PUSH, POP operations
3. Reverse a string using stack
4. Check for balanced parentheses by using Stacks
5. Implement Stack using Linked List
6. Demonstration of Linear Queue, Circular Queue, Priority Queue
7. Reverse stack using queue
8. Practical based on binary search tree implementation with its operations
9. Graph implementation and graph traversals
10. Implementation of Hashing
11. Practical based on Brute Force technique
12. Practical based on Greedy Algorithm-Prim’s/Kruskal’s algorithm
13. Practical based on Divide and Conquer Technique-Binary Search, Tower of Hanoi
14. Implementation of Dynamic Programming- LCS, Regular Expression Matching
15. Practical based on backtracking- N Queen’s problems