**Advanced Data Structures & Algorithm Analysis**

**MICRO SYLLABUS**

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| **Course Code:** | 23CS3301/ 23AM3301/23DS3301 | **Year:** | II | **Semester:** | I |
| **Course Category:** | Professional Core Course | **Branch:** | CSE/ AI&ML/DS | **Course Type:** | Theory |
| **Credits:** | 3 | **L-T-P:** | 3-0-0 | **Prerequisites:** | Data Structures,  Object Oriented Programming |
| **Continuous Internal Evaluation:** | 30 | **Semester End Evaluation:** | 70 | **Total Marks:** | 100 |

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| **COURSE OUTCOMES** | | |
| Upon successful completion of the course, Student will be able to | | |
| **CO1** | Understand the fundamental concepts of algorithm analysis and design techniques. | **L2** |
| **CO2** | Apply various algorithm design techniques for solving problems | **L3** |
| **CO3** | Apply the concepts of Trees and Graphs for solving problems effectively. | **L3** |
| **CO4** | Analyze the given scenario and choose appropriate algorithm design for solving problems. | **L4** |

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| **Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)** | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **CO2** | 2 |  |  |  |  |  |  |  | 1 | 1 |  | 1 | 1 | 1 |
| **CO3** | 2 |  |  |  |  |  |  |  | 1 | 1 |  | 1 | 1 | 1 |
| **CO4** |  | 2 |  |  |  |  |  |  | 1 | 1 |  | 1 |  | 1 |

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| **Unit No.** | **SYLLABUS CONTENTS** | **Mapped CO** |
| **I** | **Introduction:** Algorithm Analysis: Understand definition and characteristics of algorithm, and conventions used for specification of algorithm.  Space complexity, Time Complexity analysis: Count variable method, Frequency count method. Asymptotic Notations: Big Oh, Big omega, Theta notations  **Trees –** AVL: Single Rotation, Double Rotation, ADT operations: insertion, deletion, searching, traversing a tree.  **B-Trees**: representation, ADT operations: Insertion, deletion, traversing a tree | **CO1, CO3** |
| **II** | **Heap Trees** (Priority Queues) – Priority queue definition, representation, construction of Min and Max Heaps, Operations: insertion, deletion  **Graphs** – Terminology, Representations: adjacency matrix, adjacency list, incidence matrix, Basic Search and Traversals techniques: BFS, DFS, Sets and Disjoint set Union: Simple union, simple find, | **CO1,CO3** |
| **III** | **Divide and Conquer:** General Method: Recurrence relations – substitution method, **Applications**: Max-Min, Quick Sort, Merge Sort, Strassen’s matrix multiplication  **Greedy Method:** General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees: Prims, Kruskal’s, Single Source Shortest Paths :Dijkstra’s algorithm | **CO1, CO2,CO3, CO4** |
| **IV** | **Dynamic Programming:** General Method, All pairs shortest paths, Single Source Shortest Paths- General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing,: LCS problem, Travelling Salesperson problem. | **CO1, CO2,CO3, CO4** |
| **V** | **Backtracking:** General Method, n-Queens Problem (upto n=4), Sum of Subsets problem, Graph Coloring,  **Branch and Bound:** The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.  **Introduction to Complexity classes:** P and NP: definitions:- P class, NP class, NP complete problems. | **CO1, CO2,CO3, CO4** |

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| **Learning Resources** |
| **Text Books** |
| 1.Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2ndEdition  Universities Press  2.Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition  University Press  3. Fundamentals of Computer Algorithms, Ellis Horowitz, SartajSahni , Sanguthevar Rajasekaran, 2nd  Edition, Universities Press, |
| **References Text Book** |
| 1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia 2. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill 3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997. 4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995 5. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub. 6. Data structures in Java:, Thomas Standish, Pearson Education Asia |
| **e-Resources and other Digital Material** |
| 1. <https://www.tutorialspoint.com/advanced_data_structures/index.asp> 2. <http://peterindia.net/Algorithms.html> 3. Abdul Bari,[Introduction to Algorithms (youtube.com)](https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O) |