## Paper Code: CECS408
**Title of Paper:** Advanced Data Structures and Algorithms

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
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| **I** | **Priority Queues and Heaps**  
What is a Priority Queue? Priority Queue ADT, Priority Queue, Applications, Priority Queue Implementations, Heaps and Binary Heaps, Binary Heaps, Heapsort, Priority Queues [Heaps]: Problems & Solutions  
**Disjoint Sets ADT**  
Introduction, Equivalence Relations and Equivalence Classes, Disjoint Sets ADT, Applications, Tradeoffs in Implementing Disjoint Sets ADT, Fast UNION Implementation (Slow FIND), Fast UNION Implementations (Quick FIND), Summary, Disjoint Sets: Problems & Solutions |
| **II** | **Sorting**  
What is Sorting? Why is Sorting Necessary? Classification of Sorting Algorithms, Other Classifications, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Merge Sort, Heap Sort, Quick Sort, Tree Sort  
Comparison of Sorting Algorithms, Linear Sorting Algorithms, Counting Sort, Bucket Sort (or Bin Sort), Radix Sort, Topological Sort, External Sorting, Sorting: Problems & Solutions  
**Searching**  
| **III** | **Graph Algorithms**  
Introduction, Glossary, Applications of Graphs, Graph Representation  
Graph Traversals, Topological Sort, Shortest Path Algorithms, Minimal Spanning Tree, Graph Algorithms: Problems & Solutions  
**Selection Algorithms [Medians]**  
What are Selection Algorithms? Selection by Sorting, Partition-based Selection Algorithm, Linear Selection Algorithm - Median of Medians Algorithm, Finding the K Smallest Elements in Sorted Order  
Selection Algorithms: Problems & Solutions |
| **IV** | **Symbol Tables**  
Introduction, What are Symbol Tables? Symbol Table Implementations, Comparison Table of Symbols for Implementations  
**Hashing**  
What is Hashing? Why Hashing? HashTable ADT, Understanding Hashing  
Components of Hashing, Hash Table, Hash Function, Load Factor, Collisions, Collision Resolution Techniques, Separate Chaining, Open Addressing, Comparison of Collision Resolution Techniques, How Hashing Gets O(1) Complexity? Hashing Techniques, Problems for which Hash Tables are not suitable, Bloom Filters, Hashing: Problems & Solutions  
**String Algorithms**  
Introduction, String Matching Algorithms, Brute Force Method,  |

Total Credit: 04  
Total Marks: 70  
Time: 3 Hrs
| V | **Dynamic Programming**  
**Complexity Classes**  
Introduction, Polynomial/Exponential Time, What is a Decision Problem? Decision Procedure, What is a Complexity Class? Types of Complexity Classes Reductions, Complexity Classes: Problems & Solutions | 20% |

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<th>Basic Text &amp; Reference Books :-</th>
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<tbody>
<tr>
<td>1. Data Structures And Algorithmic Thinking With Python, Narasimha Karumanchi, CareerMonk Publications</td>
</tr>
<tr>
<td>2. Introduction to Algorithms, Thomas H. Cormen, Prentice-Hall of India</td>
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