



**Computer Science Paper-I**  
**Data Structures and Algorithms-I**  
**[CORE COURSE]**

<b>Semester – III</b>	<b>Credits: 2</b>	<b>Subject Code: BS32101</b>	<b>Lectures: 36</b>
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**Course Outcomes:**

**At the end of this course, the learner will be able to:**

- Illustrate different methods of organizing the large amount of data.
- Summarize well-organized data structures in solving various problems.
- Compare and contrast the usage of various data structures in problem solving.
- Demonstrate algorithms to solve problems using appropriate data structures.

**Unit 1: Introduction to Data Structures and Algorithm Analysis**

**4**

- Introduction
  - Need of Data Structure
  - Definitions -Data and information, Data type, Data object, ADT, Data Structure
  - Types of Data Structures
- Algorithm analysis
  - Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic, quadratic loop etc.
  - Best, Worst, Average case analysis, Asymptotic notations(Big O, Omega  $\Omega$ , Theta  $\Theta$ ), Problems on time complexity calculation

**Unit 2: Array as a Data Structure**

**10**

- ADT of an array, Operations
- Array applications -Searching
  - Sequential search, variations -Sentinel search, Probability search, ordered list search
  - Binary Search
  - Comparison of searching methods
- Sorting Terminology-Internal, External, Stable, In-place Sorting
  - Comparison Based Sorting-Lower bound on comparison based sorting, Methods-Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies -Divide and Conquer strategy, Merge Sort, Quick Sort, complexity analysis of sorting methods.
  - Non Comparison Based Sorting: Counting Sort, Radix Sort, complexity analysis.
  - Comparison of sorting methods

**Unit 3: Linked List**

**10**

- Introduction
- Dynamic implementation of Linked List

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• Types of Linked List –Singly, Doubly, Circular	
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<ul style="list-style-type: none"> <li>• Operations on Linked List -create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.</li> <li>• Applications of Linked List –polynomial representation, Addition of two polynomials</li> <li>• Generalized linked list –concept, representation, multiple-variable polynomial representation using generalized list.</li> </ul>	
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<b>Unit 4: Stack</b>	<b>6</b>
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<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Operations –init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.</li> <li>• Implementation-Static and Dynamic with comparison</li> <li>• Applications of stack</li> <li>• Function call and recursion, String reversal, palindrome checking</li> <li>• Expression types -infix, prefix and postfix, expression conversion and evaluation(implementation of infix to postfix, evaluation of postfix)</li> </ul>	
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<b>Unit 5: Queue</b>	<b>6</b>
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<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Operations -init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack.</li> <li>• Implementation-Static and Dynamic with comparison</li> <li>• Types of Queue-Linear Queue, Circular Queue(with implementation), Priority Queue, Double Ended Queue</li> <li>• Applications of Queue</li> </ul>	
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**\*Contact Hours:12**

<b>Recommended Books:</b>	
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<ul style="list-style-type: none"> <li>• DebasisS.(2009).<i>Classic Data Structures</i>. Prentice Hall India Pvt. Ltd.</li> <li>• Horowitz E., SahniS.,Anderson-Freed s. (2008).<i>Fundamentals of Data Structures in C</i> . Universities Press.</li> <li>• KamthaneA.N.(2009). <i>Introduction to Data Structures in C</i>.Pearson Education.</li> <li>• Wirth N. (1976).<i>Algorithms and Data Structures</i>. Pearson Education.</li> </ul>	
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Board Of Studies	Name	Signature(In white cell)	
Chairman (HoD)	Ms. Ashwini Kulkarni	<i>Ashwini</i> 6/3/21	
Faculty	Ms. Alka Kalhapure		<i>Alka</i> 06/03/2021
Faculty	Ms.Shubhangi Jagtap	<i>Shubhangi</i> 06/03/21	
Subject Expert (Outside SPPU)	Dr. Manisha Divate		<i>Manisha Divate</i> 6/3/21
Subject Expert (Outside SPPU)	Mr. Aniket Nagane	<i>Aniket</i> 6/3/21	
VC Nominee (SPPU)	Dr. Manisha Bharambe		<i>Manisha Bharambe</i> 06/03/21
Industry Expert	Ms.SnehalBiyala	<i>Snehal</i> 6/3/21	
Alumni	Ms. Mamta Choudhary		<i>Mamta</i> 6/3/21

Board Of Studies	Name	Signature
Chairman (HoD)	Ms. Ashwini Kulkarni	<i>Ashwini</i>