

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)	<b>COURSE SYLLABI</b> <b>(2019 – 2023)</b>	
<b>SCHOOL OF COMPUTER ENGINEERING AND TECHNOLOGY</b>	<b>W.E.F</b>	2020- 2021
<b>SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING</b>	<b>COURSE NAME</b>	Data Structures
	<b>COURSE CODE</b>	CS221
	<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/07/2020</b>	<b>REVISION NO</b>	1.0

TEACHING SCHEME  (HOURS/WEEK)		EXAMINATION SCHEME & MARKS						
		THEORY			PRACTICAL			TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	MSE	ESE	IA	
3	NIL	35	35	30	NIL	NIL	NIL	100

**PRE-REQUISITE:** CS101 Logic Development- C Programming

#### **COURSE OBJECTIVES:**

- CS221.CEO.1: To illustrate fundamental data structures and their applications in programming and problem solving.
- CS221.CEO.2: To understand abstract data representation methods.
- CS221.CEO.3: To build the ability to synthesize and analyze algorithms.
- CS221.CEO.4: To identify appropriate data structure for the specified problem.
- CS221.CEO.5: To understand the various techniques of searching and sorting.
- CS221.CEO.6: To analyze different sorting and searching algorithms.

#### **COURSE OUTCOMES:**

- Students successfully completing the course will be able to,
- CS221.CO.1: Explain the concept of data structure.
- CS221.CO.2: Develop efficient algorithm for a given problem.
- CS221.CO.3: Analyze appropriate algorithm for solving the real world problem.
- CS221.CO.4: Demonstrate advantages and disadvantages of data structures for variety of problems.
- CS221.CO.5: Choose effective data structures in approaching a problem solution.
- CS221.CO.6: Make use of appropriate sorting and searching algorithm for a given application.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>INTRODUCTION TO DATA STRUCTURES</b>	<b>5 HOURS</b>
App/System/Case Study: Social networking, Recommendation system , Map applications Contents: Introduction to Data Structures, Data object, Abstract Data Types (ADT), Classification of data structure, time and space complexity ( iterative and recursive algorithms), Classification of algorithmic complexities( constant time to exponential/factorial time), Asymptotic notation( big O, theta and omega) and its significance, efficiency of algorithms, Performance measures for data structures. Self-study: Analysis of algorithms for time complexity Further reading: Case study of time complexity.		
<b>UNIT 2</b>	<b>ARRAY</b>	<b>6 HOURS</b>
App/System/Case Study: Election Voting System, Slide puzzle game Contents: Array as data structure, Representation and address calculation of array, two dimensional and multidimensional arrays, operations on arrays: Insertion, deletion, searching, sorting, and traversing, Polynomial and its operations using arrays, sparse matrix and its operations(addition,multiplication,transpose and fast transpose ) using array Self-study: Conversion functions of sparse matrix Further reading: Array and database		
<b>UNIT 3</b>	<b>Linked List</b>	<b>10HOURS</b>
App/System/Case Study: Process management in Linux, Account Management System, Shuffle merging system for set of two integer sets Contents: Linked lists, Representation of linked list, comparison of sequential and linked list organizations, Types of linked list (Singly linked list, Doubly Linked list, Singular and doubly Circular linked list), operations on linked list: insertion, deletion, traversing, searching, concatenation, merging and sorting, Polynomials using linked list Self-study: Garbage collection and linked list Further reading: Web indexing using linked list		
<b>UNIT 4</b>	<b>STACK</b>	<b>7 HOURS</b>
App/System/Case Study:Josephus problem, CPU Scheduling Contents: Stack, Stack as ADT, representation and implementation of stack using sequential linked organization, operations on stack, Expression conversion (infix, prefix, postfix ), Expression evaluation, recursion,types of recursion(direct,indirect,tail and tree recursion), Use of stack in recursion and backtracking Self-study: Role of stack in memory management Further reading: Use of stack in Language processing		

<b>UNIT 5</b>	<b>Queue</b>	<b>6 HOURS</b>
App/System/Case Study: Syntax checker system for matching braces, Maze solving system Contents: Queue, Queue as ADT, representation and implementation of linear queue and circular queue using sequential linked organization, double ended queue and Priority queue and its operations (insertion, removal, empty and peek). Self-study: Concurrent priority queues Further reading: Bandwidth management using priority queue		
<b>UNIT 6</b>	<b>SEARCHING AND SORTING</b>	<b>6 HOURS</b>
App/System/Case Study: Employee leave management system for an organization Contents: Searching and different techniques of searching (sequential, binary, Fibonacci, sentinel), Comparison of Searching techniques, Sorting and different sorting techniques (selection sort, insertion sort, radix sort, and quick sort), Comparison of sorting techniques Self-study: Merge sort Further reading: Organisation of books in library management system		
<b>TEXT BOOK</b>		
1. E. Horowitz S. Sahani, D. Mehta, Fundamentals of Data Structures in C++ , Seventh Edition, Universities Press ,2008, IS BN-13: 978-8173716065. 2. T. Cormen, C Leiserson, R. Rivest, C Stein, Introduction to Algorithms, MIT press,2009, ISBN-13: 978-0262533058 3. ‘Michael T. Goodrich, Roberto Tamassia, David M. Mount, Data Structures and Algorithms in C++, John Wiley Sons, ISBN-13: 978-0470383278		
<b>REFERENCE BOOK</b>		
1. Richard F. Gilberg, Behrouz A Forouzan, Data structures- A pseudocode Approach with C++ Second edition , Cengage learning, 2004, 9780534390808. 2. E.Horowitzs S. Sahani, S. Rajashekharan, Fundametals of Computer Algorithm s, Universities Press, 2008,ISBN-13: 978-8 173716126 3. Debasis Samanta, Classic Data Structures, Second Edition, TMH, 2009, ISBN-13: 978-8120337312		