

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus Institute of Engineering & Management, New Town CampusUniversity of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2023

Subject Name: Data Structure and Algorithms Credit: 3

Lecture Hours: 36

Subject Code: PCC301

Pre-requisite: Introduction to Programming **Relevant Links:**

Study Material Coursera NPTEL LinkedIn Learning

<u>g</u><u>Infosy</u>

Infosys Springboard

COURSE OBJECTIVES:

- 1. To acquire knowledge of fundamental data structures.
- 2. To be able to implement any problem by writing their own algorithms.
- 3. To analyze an algorithm for a given problem using different data structures.
- 4. To learn various data structure approaches and techniques to develop and design projects.



COURSE OUTCOMES:

CO1	Students will be able to acquire and remember the knowledge of fundamental data
	structures.
CO2	Students will be able to implement any problem by writing their own algorithms.
CO3	Students will be able to analyze the algorithm for a given problem using different data
	structures.
CO4	Students will be able to learn various data structure approaches and techniques to
	develop and design projects.

Module number	Торіс	Sub-topics	Mapping with Industry and International Academia	Lecture Hours		Book- Chapter Mapping
1	Introdu	Why do we need data structure?	International Academia:	10	1) Write a Program to	1. Reema Thareja-
	ction		Advanced Data Structures		generate the Armstrong	Chapter 2
		Concepts of data structures: a) Data	Electrical Engineering and		numbers from N to M.	
		and data	Computer Science MIT			2.Debasis Samanta
		structure b) Abstract Data Type and	<u>OpenCourseWare</u>		2) Write a Program to	– Chapter 1
		Data Type			print the following	
			AICTE-prescribed		sequence of numbers:	3.Aaron M.
		Applications Algorithms and	syllabus:		0,1,1,2,3,5,8,13,21,34	Tannenbaum–
		programs.				Chapter I
			CTE Model Curriculum for		3) Twenty five numbers	
		The basic idea of pseudo-code.	(aicte-india.org)		are entered from the	
					keyboard. Write a	
		Algorithm efficiency and analysis.	Industry Mapping:		program to find out how	
		Time and appear complexity analysis	Various web-based and		many of them are positive,	
		of algorithms order potations	standalone compilers,		now many are negative,	
		of algorithms – order notations.	Programming practice in		now many are even and	

2	Lincor	A move Different representations	Hackerrank, Leetcode GeeksforGeeks platform.	how many odd. 4) WAP a program to check if a given string is palindrome or not (the user may choose an example string).	1 Reema Thareia
2	Linear Data Structur es	 Array: Different representations – row-major, column-major [1L]; Sparse matrix - its implementation and usage [1L]; Array representation of polynomials [1L]; Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomials and applications [2L]; Stack and Queue: Stack and its implementations (using array, using linked list), applications (Infix to Postfix conversion, Evaluation of Postfix expression etc.) [2L]; Queue, circular queue, dequeue [1L]; Implementation of queue- both linear and circular (using array, using linked 	International Standards : Advanced Data Structures Electrical Engineering and Computer Science MIT OpenCourseWare	 Write a program using array where we can find maximum and second maximum number. Write a program to search the location of a given element in array and after searching delete that element from array. Write a program to perform the push and pop operations in a stack. Write a program for infix to postfix conversion using stack. Write a program for performing the insert and delete operations in a queue. 	 Reema Thareja Chapter 3, 6, 7, 8 2.Debasis Samanta Chapters 2, 3, 4, Garage and the second second

list), Applications [1L];		
		6) Write a menu driven
Recursion: Principles of recursion		program for the following
use of the stack, differences between	en	operation of a Singly
recursion and iteration, tail recursi	on.	Linked List. A)Insert a node at
Applications - Tower of Hanoi [1]		heginning
	1.	B)Insert a node as per
		given position
		GNE and a state and
		C)Insert a node at the end
		of the linked list.
		D)Delete a node at
		beginning
		E)Delete a node as per
		given position.
		F)Delete a node at the last
		of the linked list
		of the linked list.
		7) Write a C program to
		linked lists
		mixed libbs.
		8)Write a Program to
		implement the procedure
		of Tower of Hanoi using
		recursion.
		9) You are given an array
		of size N. You can
		perform an operation in
		which you will remove the
		all all and the smallest
		and you will add their
		difference at the end of the
		array. So, finally the array
		size will be decreased by 1
		after each such operation.

		You are given Q tasks and in each task, you are given
		an integer K. For each
		ask, you have to print the
		the array after such k
		operations
		operations.
		10) Suppose there is a
		circle. There are N petrol
		pumps on that circle. You
		will be given two sets of
		data.
		1. The amount of petrol
		that every petrol pump
		has.
		2. Distance from that
		petrol pump to the next
		petrol pump.
		Find a starting point where
		the truck can start to get
		through the complete
		circle without exhausting
		Noto: Assume for 1 litre
		note. Assume for 1 mile
		unit of distance
		unit of distance.

			AICTE prescribed			
			syllabus:			
			CTE Model Curriculum			
			for (aicte-india.org)			
			Industry Mapping:			
			Various web-based and			
			standalone compilers,			
			Programming practice in			
			Hackerrank, Leetcode,			
	NT 11		GeeksforGeeks platform.	10		
3	Nonlinear Doto	Trees: Basic terminologies,	International Standards:	12	1) Write a Program to	1. Reema Thareja – Chapters 0, 13
	structures	tree representation (using array,	Advanced Data Structures		insert and delete a	Chapters 9, 15
	sti uctui es	using linked list);	Electrical Engineering			2. Debasis Samanta –
		Binary trees - binary tree	and Computer Science		2) Write a Program	Chapters 7, 8
		traversal (pre-, in-, post- order),	MIT OpenCourse ware		for Tree Traversal in	-
		recursive and non-recursive	AICTE prescribed		Pre-order.	3. Aaron M.
		traversal algorithms of binary	syllabus:			Tannenbaum –
		tree, threaded binary tree (left,			3) Write a Program	Chapters 5, 8
		right, full), and expression tree;	CTE Model Curriculum		for Tree Traversal in	
		Binary search tree- operations	for (aicte-india.org)		In-order.	
		(creation, insertion, deletion,	Industry Manning.			
		searching). Height balanced	maasi y mapping.		4) Write a Program to	
		binary tree – AVI tree	Various web-based and		implement the Tree	
		(insertion deletion with	standalone compilers,		Traversal in Post-order	
		examples only):	Programming practice in			
		D Trace	Hackerrank, Leetcode, GeeksforGeeks platform		5) White a Dragnom to	
		B- Trees – operations	OccusionOccus planolini.		b) while a Program to	
		(insertion, deletion with			implement the BFS	
		examples only);			procedure.	
		B+ Trees – operations				
		(insertion, deletion with			6) Write a Program to	
		examples only) [1L];			implement the DFS	

		a la	procedure.
G	Graphs: Graph definitions and		
co	oncepts (directed/undirected	7	7) Robert lives in a town.
gı	raph, weighted/un-weighted	H	He has made some crafts
ec	dges, subgraph, degree, cut	a	and want to make some
ve	rertex/ articulation point,	n	noney out of it. So he
pe	endant node, clique, complete	d	lecides to visit every city
gı	raph, connected components –	С	on the state and sell his
st	trongly connected component,	с	crafts. Now there are
W	veakly connected component,	n	nultiple routes to visit
pa	ath, shortest path, and	е	every city in that state
is	somorphism); Graph	а	and each route has
re	epresentations / storage	d	lifferent travel fares.
in	mplementations – adjacency	F	Robert knows all the
m	natrix, adjacency list,	r	outes and the travel
ac	djacency multi-list;	f	ares. Help Robert to
G	Graph traversal and	i i	dentify a route where he
co	onnectivity – Depth-first	с	can spend less money
se	earch (DFS), Breadth-first	v	while going to each city
se	earch (BFS) – concepts of	а	and returning home.
ec	dges used in DFS and BFS	n	Take the User Input
(t	tree-edge, backedge, cross-	F	Format as following:
ec	dge, forward-edge);	1	N = no of cities in the
ar	pplications. Minimal spanning	s	state
tr	ree – Prim's algorithm,	1	fare[][] = 2D matrix
K	Kruskal's algorithm (basic idea	s	showing the fares for
lo	f greedy methods).	е	each route.

4	Searching	Sorting Algorithms: Bubble sort.	International Standards:	4	1) You are given a	1. Reema Thareja –
	and	insertion sort shell sort selection sort	Advanced Data Structures		list of n-1 integers	Chapters 14, 15
	Sorting.	marga sort quick sort has sort	Electrical Engineering		in the range from 1	
	Solung.	inerge sort, quick sort, neap sort	and Computer Science		to n. There are no	2. Debasis Samanta –
		(concept of max heap, application –	MIT OpenCourseWare		duplicates in the	Chapter 6, 10
		priority queue), radix sort; Time and			list. One of the	
		space complexity derivations;	AICTE prescribed		integers from 1 to n	3. Aaron M. Tannenbaum
			syllabus:		is missing in the	– Chapters 6, 7
		Searching: Sequential search, binary	2		program in C to	
		search interpolation search Time and	CTE Model Curriculum		find the missing	
		space complexity derivations	for (aicte-india.org)		integers.	
		space complexity derivations.			Note the user input	
			Industry Mapping:		format as:	
		Hashing: Hashing functions,	Various web based and		p = size of array	
		collision resolution techniques.	standalone compilers		a = enter the array	
			Programming Practice in		elements.	
			Hackerrank. Leetcode.			
			GeeksforGeeks platform.		2) A class has "n"	
			L		students They are	
					standing in a queue	
					and not roll	
					number wise.	
					Write a program in	
					C to let them enter	
					the classroom in a	
					Sorted Manner	
					based on their roll	
					ascending order)	
					Note the User innut	
					format as:	
					n = number of students	
					in the aueue.	
					a = enter their roll	
					numbers in the array as	
					numbers in the array as	

			they are standing (random order).

TEXT BOOK:

- 1. "Classic Data Structures" by Debasis Samanta.
- 2. "Data Structures using C" by Aaron M. Tanenbaum.
- 3. "Data Structures using C" by Reema Thareja.

REFERENCE BOOKS:

- 1. "Data Structures", by Mark Allan Weiss.
- 2. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
- 3. "Data Structures Schaum ASE" by Seymour Lipschutz.