

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: <i>IM.Sc. Computer Science</i>				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Major Core - 2	21P1DMC2	Data Structures And Algorithms in C++	4	5	25	75	100

Nature of Course			
Knowledge and skill			Employability oriented
Skill oriented	✓		Entrepreneurship oriented

### Course Objectives

1. To impart knowledge on fundamental ADTs.
2. To learn the organized structures of Trees and Hashing.
3. To understand the concepts of updatable Queues and Sorting
4. To apply the Graph Algorithms on related applications.
5. To design optimized algorithms with efficacy.

Unit	Content	Hrs	K-Level	CLO
I	<b>Algorithm Analysis and Lists, Stacks, &amp; Queues : Algorithm Analysis:</b> Mathematical Background – Model – What to Analyze – Running –Time Calculations. <b>Lists, Stacks, &amp; Queues:</b> Abstract Data Types – The List ADT – The Stack ADT – The Queue ADT.	15	Up to K2	1
II	<b>Trees and Hashing : Trees:</b> Preliminaries – Binary Trees – The Search Tree ADT - Binary Search Trees – AVL Trees – Tree Traversals – B-Trees – <b>Hashing:</b> General Idea – Hash Function – Separate Chaining – Hash Tables without Linked Lists – Rehashing – Universal Hashing – Extendible Hashing.	15	Up to K3	2
III	<b>Priority Queues (Heaps) and Sorting :</b> Model – Simple Implementation – Binary Heap – Applications of Priority Queues – d-Heaps – Leftist Heaps – Skew Heaps – Binomial Queues – <b>Sorting:</b> Preliminaries - Insertion Sort – A Lower Bound for Simple Sorting Algorithms – Shell Sort – Heap Sort – Merge Sort – Quick Sort – External Sorting .	15	Up to K3	3
IV	<b>Graph Algorithms :</b> Definitions – Topological Sort – Shortest Path Algorithms –Network Flow Problems - Minimum Spanning Tree – Applications of Depth First Search – Introduction to NP-Completeness.	15	Up to K4	4
V	<b>Algorithms Design Techniques:</b> Greedy Algorithms – Divide and Conquer – Dynamic Programming – Randomized Algorithms – Backtracking Algorithms.	15	Up to K5	5

## **Book for Study**

Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss, Fourth Edition, Pearson Publications.

## **Chapters**

**Unit I:** 2, 3.1, 3.2, 3.5 – 3.7

**Unit II :** 4.1 – 4.4, 4.6, 4.7, 5.1 – 5.5, 5.8, 5.9

**Unit III:** 6.1 - 6.8, 7.1 – 7.7, 7.12

**Unit IV:** 9

**Unit V:**10

## **Books for Reference**

1. Data Structures with C by Seymour Lipchitz, Mc Grow Hill Publications.
2. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, Second Edition, Pearson Publications.
3. An Introduction to Data Structure with Application by Jean-Paul Tremblay, Paul Sorenson, TMH, II Edition – 1991.

## **Web Resources**

1. <http://freecodecamp.org>
2. <https://www.dzone.com>
3. <https://lecturenotes.in>

## **Rationale for Nature of the course**

- The methods and techniques of data structure are widely used in system programming and application programming.
- Helps to develop logic and structured program by using organized data.

## **Activities on Skill Oriented**

- Practice to write Algorithms
- Seminar
- Data Organization

## **Pedagogy**

Chalk and talk Materials, PPT, Assignment, Seminar, Group Discussion and Interaction.

## **Course Designer(s) Name**

1. Mr. K. RajaSaravanaKumar
2. Mrs. R. LakshaPriya

## Lesson Plan

Unit	Topics to be Covered	Hours	Mode
I	Algorithm Analysis	7	Chalk and talk
	Lists, Stacks, & Queues	8	Group Discussion
II	Trees	3	Chalk and talk, Materials
	AVL Tree	3	PPT
	Hashing	5	Chalk and talk, PPT
	Rehashing	4	Chalk and talk, PPT
III	Priority Queues (Heaps)	4	Chalk and talk, PPT
	Binomial Queues	4	Chalk and talk, PPT
	Sorting	4	Group Discussion
	Shell Sort – Heap Sort – Merge Sort – Quick Sort –	4	Chalk and talk, Group
	External Sorting	3	Discussion
IV	Graph Algorithms	7	Chalk and talk, PPT
	Minimum Spanning Tree	8	Chalk and talk, PPT
V	Algorithms Design Techniques	8	Chalk and talk, Group
	Randomized Algorithms – Backtracking Algorithms	7	Discussion, Assignment Chalk and talk, Seminar

## Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Level
<b>CLO 1</b>	Design and analyze the problem statements and various ADTs.	<b>Up to K2</b>
<b>CLO 2</b>	Gain knowledge of non linear data structure like trees and hash which can be applied to solve problems.	<b>Up to K3</b>
<b>CLO 3</b>	Describe the computational efficiency of various sorting techniques.	<b>Up to K3</b>
<b>CLO 4</b>	Design and implement the graph operations and its application.	<b>Up to K4</b>
<b>CLO 5</b>	Analyze the complexity of different algorithms to solve real life problems	<b>Up to K5</b>

## Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
<b>CLO 1</b>	3	2	3	3	2	-
<b>CLO 2</b>	3	3	3	3	2	-
<b>CLO 3</b>	3	3	3	2	2	2
<b>CLO 4</b>	3	3	3	3	2	2
<b>CLO 5</b>	3	3	3	3	2	-

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

## Continuous Internal Assessment (CIA): 25 Marks

Components	Marks	K Level
Test (Average of two tests) (Conducted for 40 marks and converted into 10 marks)	10	(Refer Next Table)
Assignment	5	K4
Seminar	5	K5
Quiz	5	K4
Total	25	

**Learning Outcome Based Education & Assessment (LOBE)**  
**Formative - Blue Print – Model for Data Structures and Algorithms in C++**  
**Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
<b>CIA I</b>	CLO 1	Up to K2	2	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	3	K1	2(K2&K2)	1(K3)
<b>CIA II</b>	CLO 3	Up to K3	2	K2	2(K3&K3)	2(K3)
	CLO 4	Up to K4	3	K2	2(K4&K4)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		<b>10</b>		<b>10</b>	<b>20</b>

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

**Distribution of Section-wise Marks with K Levels \***

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	<b>20</b>	33.33	<b>83</b>
K2	-	10	20	<b>30</b>	50	
K3	-	-	10	<b>10</b>	16.67	<b>17</b>
K4	-	-	-	-	-	-
<b>Total Marks</b>	<b>10</b>	<b>20</b>	<b>30</b>	<b>60</b>	<b>100</b>	<b>100</b>

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	-	-	-	-	-	<b>17</b>
K2	10	-	-	<b>10</b>	16.67	
K3	-	10	20	<b>30</b>	50	<b>50</b>
K4	-	10	10	<b>20</b>	33.33	<b>33</b>
<b>Total Marks</b>	<b>10</b>	<b>20</b>	<b>30</b>	<b>60</b>	<b>100</b>	<b>100</b>

**Learning Outcome Based Education & Assessment (LOBE)**  
**Summative - Blue Print – Model for Data Structures and Algorithms**  
**Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

UNITS	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to K5	2	K3 & K4	1	K3	2(K4&K4)	1(K5)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analysing, presentation and make inferences with evidences
- K5 – Ability to integrate ideas from one situation to newer situations.

**Distribution of Section – wise Marks with K Levels \***

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
<b>K1</b>	2	4	10	-	<b>16</b>	13.33%	13%
<b>K2</b>	2	4	10	10	<b>26</b>	21.67%	22%
<b>K3</b>	4	2	10	20	<b>36</b>	30%	30%
<b>K4</b>	2	-	20	10	<b>32</b>	26.67%	27%
<b>K5</b>	-	-	-	10	<b>10</b>	8.33%	8%
<b>Total Marks</b>	10	10	50	50	<b>120</b>	100	100