Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY
BANGALORE

COURSE PLAN

Academic Year FEB 2019

Program:	B E – Computer Science Engineering
Semester :	3
Course Code:	18CS32
Course Title:	Data Structure And Application
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	AKSHATHA KAMATH

Academic Evaluation and Monitoring Cell

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Table of Contents

Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	CS
Year / Semester :	2/4	Academic Year:	2019-20
Course Title:	Data Structure And Application	Course Code:	18CS32
Credit / L-T-P:	4/L	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	60 Marks
CIA Marks:	30	Assignment	5/ 5
Course Plan Author:	Akshatha Kamath	Sign	Dt:
Checked By:		Sign	Dt:
CO Targets	CIA Target : ..... %	SEE Target:	..... %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming	10	DS conventions, Data Manipulation	L3
2	Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion,evaluation of postfix expression, Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi,Ackerman's function. Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function.	10	Sequential storage representation ,solving mathematical problem	L3
3	Linked Lists:Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples	10	Linked storage representation	L3
4	Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, 4 Binary Tree Traversals – Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition,Insertion, Deletion, Traversal, Searching, Application of Trees- Evaluation of Expression,	10	Binary Tree Properties,Data Hierarchy	L3

	Programming Examples			
5	Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing	10	Traversal Methods,problem solving ,tables and file organizations	L3
-	**Total**	**50**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2, 3, 4, 5	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2 Edition, Universities Press, 2014.	1,2,3,4,5, 6	In Lib / In Dept
1, 2, 3, 4, 5	Seymour Lipschutz, Data Structures Schaum's Outline s, Revised 1 st Ed, McGraw Hill, 2014.	1,2,3,4,5, 6,7,8,9	
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2,3,4,5	Gilberg & Forouzan, Data Structures: A Pseudocode approach with C, 2ndEd, Cengage Learning,2014		In Lib
5	Reema Thareja, Data Structures using C, 3 rd Ed, Oxford press, 2012.	16	
1	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2 nd Ed, McGraw Hill, 2013		In lib
1, 2,3,4,5	A M Tenenbaum, Data Structures using C, PHI, 1989	1	
1, 2,3,4,5	Robert Kruse, Data Structures and Program Design in C, 2 nd Ed, PHI, 1996		
C	**Concept Videos or Simulation for Understanding**	-	-
C1	https://www.toolsqa.com/data-structures-tutorial/		
C2	https://www.quora.com/What-are-some-good-websites-to-learn-data-structures-and-algorithms		
C3	https://www.tutorialspoint.com/data_structures_algorithms/		
C4	https://www.hackerearth.com/blog/developers/study-data-structures-algorithms/		
D	**Software Tools for Design**	-	-
	https://opendsa-server.cs.vt.edu/ODSA/Books/CS2/html/IntroDSA.html		
	https://www.dlubal.com/en/products/rfem-fea-software		
E	**Recent Developments for Research**	-	-
	https://www.sciencedirect.com/science/article/pii/009605517890005X		
	https://technav.ieee.org/tag/500/data-structures		
	https://www.coursera.org/specializations/data-structures-algorithms		

F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1	https://visualgo.net/en		

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	17pcd13/23	C Programing	1. Knowledge on Data Structures	1/2		Understand L2
2						
-						
-						

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1				
3				
3				
5				
-				
-				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	17cs33.1	Learn data structure classification for array,union,structure along with the memory allocation functions	3	DS conventions,	Lecture	Q & A	L2 Apply
1	17cs33.2	Apply array and string operations by manipulating methods	7	Data Manipulation	Lecture	Assignment	L3 Apply
2	17cs33.3	Compare the stack and queues concept using static and dynamic allocations	7	Sequential storage representation	Lecture	Assignment and Slip Test	L2 Understand
2	17cs33.4	Apply by solving mathematical aspects using recursion methods	3	solving mathematical problem	Lecture / PPT	Assignment	L3 Apply
3	17cs33.5	Differentiate the stacks and queues implementations with combined arrangements using linked list	10	Linked storage representa	Lecture	test	L3 Apply

				tion			
3	17cs33.6	Apply binary tree on arrays and linked list for binary tree traversal	4	Binary Tree Properties,	Lecture and Tutorial	Assignment	L3 Apply
4	17cs33.7	Apply the data hierarchy for mathematical expression	6	Data Hierarchy	Lecture	Assignment and Test	L3 Apply
4	17cs33.8	Simplify the graph using Depth first search and Breadth first search Traversal methods	4	Traversal Methods,	Lecture	Assignment	L3 Apply
5	17cs33.9	Write the function for given set of values using sorting problem solving technique	3	Problem solving	Lecture	Assignment	L3 Apply
5	17cs33.10	Examine the data to be organized in table and file formate using hashing and file operations	3	tables and file organizations	Lecture	Assignment/test	L3 Apply
-	-	**Total**	**50**	-	-	-	-

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Acquires the knowledge of various types of data structures	CO1	L2
1	Able to Perform arrays and string operations	CO2	L3
2	Able to differentiate stacks and queue data structure	CO3	L2
2	Able to perform recursion operation on different problems (factorial,GCD,Fibonacci,Tower of Hanoi)	CO4	L3
3	Able to perform the sequential and linked storage representation of data	CO5	L3
3	Able to analyze the performance of stack,queue,lists,trees	CO6	L3
4	Able to organize the data in hierarchical level using binary tree traversal and binary search tree	CO7	L3
5	Able to perform the traversal methods	CO8	L3
5	Able to analyze the searching and sorting techniques	CO9	L3
5	Able to implement and design the data structure in a high level langauage in organized manner	CO10	L3

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Mapping		Justification	Mapping Level
CO	**PO**		
CO1	**PO3**	The knowledge in allocating memory helps in organizing the data	L2
	PO4	These concepts are fundamental to CS and can be used in research and other innovative ideas.	L2
CO2	**PO3**	The knowledge of array and string helps in manipulate to perform different operation on that.	L3
	PO4	This knowledge helps to get an idea for Manipulating data that are organized	L3
CO3	**PO1**	The knowledge of arrays, linked lists, stacks and queues can be applied to solve complex engineering problems.	L3
	PO3	The knowledge of arrays, linked lists, stacks and queues can be applied to design solutions to complex engineering problems.	L3

CO4	**PO1**	The knowledge of arrays, linked lists, stacks and queues can be applied to solve complex engineering problems.	L3
	PO3		L3
CO5	**PO1**	The knowledge of arrays, linked lists, stacks and queues can be applied to design solutions to complex engineering problems in multidisciplinary areas.	L3
	PO3		
	PO4	They belong to the core concepts of CS.	L3
CO6	**PO1**	The knowledge of non linear data structures like trees and can be applied to solve complex engineering problems.	L3
	PO3	This knowledge can be used to design efficient solutions to complex problems.	L3
	PO4	This knowledge helps in representation, analysis and interpretation of data to provide valid conclusions.	L3
CO7	**PO1**		L3
	PO3		L3
	PO4		L3
CO8	**PO1**	The knowledge of non linear data structures like graphs can be applied to solve complex engineering problems.	L3
	PO3	This knowledge can be used to design efficient solutions to complex problems.	L3
	PO4	This knowledge helps in representation, analysis and interpretation of data to provide valid conclusions.	L3
CO9	**PO1**	This basic knowledge of sorting and searching can be used in solutions to complex engineering problems.	L3
	PO3	This concept is fundamental in conducting investigations and interpretations of data.	L3
	PO4	The concept of sorting and searching are fundamental to the CS discipline and can be used research and other innovative ideas.	L3
CO10	**PO1**	The knowledge of various hashing techniques can be applied in designing solutions to complex engineering problems.	L3

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	Course Outcomes	Program Outcomes												
#	COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	Level
17cs33.1	Learn data structure classification for array,union,structure along with the memory allocation functions	-	-	2	2	-	-	-	-	-	-	-	-	L2
17cs33.2	Apply array and string operations by manipulating methods	-	-	2	2	-	-	-	-	-	-	-	-	L3
17cs33.3	Compare the stack and queues concept using static and dynamic allocations	1	-	3	-	-	-	-	-	-	-	-	-	L2
17cs33.4	Apply by solving mathematical aspects using recursion methods	1	-	3	-	-	-	-	-	-	-	-	-	L3
17cs33.5	Differentiate the stacks and queues implementations with combined arrangements using linked list	2	-	3	2	-	-	-	-	-	-	-	-	L3
17cs33.6	Apply binary tree on arrays and	2	-	3	2	-	-	-	-	-	-	-	-	L3

	linked list for binary tree traversal													
17cs33.7	Apply the data hierarchy for mathematical expression	1	-	2	3	-	-	-	-	-	-	-	-	L3
17cs33.8	Simplify the graph using Depth first search and Breadth first search Traversal methods	1	-	2	3	-	-	-	-	-	-	-	-	L3
17cs33.9	Write the function for given set of values using sorting problem solving technique	1	-	2	3	-	-	-	-	-	-	-	-	L3
17cs33.10	Examine the data to be organized in table and file formate using hashing and file operations	1	-	-	-	-	-	-	-	-	-	-	-	L3
Note: Mention the mapping strength as 1, 2, or 3														

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1						
1						
2						
2						
3						
3						
4						
4						
5						
5						

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Module #	Title	Teaching Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction,Arrays and String	10	2	-	-	1	1	4	CO1, CO2	L2, L3
2	Stack And Queues ,Recursion	10	2	-	-	1	1	4	CO3, CO4	L3
3	Linked List	10	-	2	-	1	1	4	CO5	L3
4	Tree	10	-	2	-	1	1	4	CO6, CO7	L2,L3
5	Graph,Sorting,Hashing,File structure	10	-	-	4	1	1	3	C08, CO9, CO10	L3
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**19**	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	30	CO1, CO2, CO3, CO4	L1, L2, L3
CIA Exam – 2	30	CO5, CO6, CO7, C08	L2, L3
CIA Exam – 3	30	CO9, CO10	L2, L3
Assignment - 1	10	CO1, CO2, CO3, CO4	L2, L3
Assignment - 2	10	CO5, CO6, CO7, CO8	L2, L3
Assignment - 3	10	CO9, CO10	L2, L3
Seminar - 1	-	-	-
Seminar - 2	-	-	-
Seminar - 3	-	-	-
Other Activities – define – Slip test		-	-
Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction,Arrays and String	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Learn data structure classification for array,union,structure along with the memory allocation functions.	CO1	L2
2	Apply array and string operations by manipulating methods.	CO2	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction: Data Structures, Classifications (Primitive & Non Primitive),	C01	L2
2	Data structure Operations, Review of Arrays, Structures,		
3	Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions.		

4	Representation of Linear Arrays in Memory, Dynamically allocated arrays,	CO2	L3
5	Array Operations: Traversing, inserting, deleting, searching, and sorting.		
6	Multidimensional Arrays, Polynomials		
7	Sparse Matrices.		
8	Strings: Basic Terminology, Storing,		
9	Operations and Pattern Matching algorithms.		
10	Programming examples		
c	**Application Areas**	**CO**	**Level**
1	Acquires the knowledge of various types of data structures	CO1	L3
2	Able to Perform arrays and string operations	CO2	L3
d	**Review Questions**	-	-
1	What do you mean by Data Structure? Give the classification of Data Structures.	CO1	L1
2	What do you mean by Data Structure? Explain with an example.	CO1	L3
3	What are the various types of data structures? Brief with an example.	CO2	L2
4	Differentiate between linear and non – linear data structures. Explain how a structure can be represented in C.	CO2	L3
5	Define Arrays. Explain different types of arrays. How a one dimensional array can be initialized? Explain with example	CO2	L2
6	What are the various operations performed on arrays? Explain with algorithms? Write a C program to demonstrate basic array operations	CO2	L5
7	What is a sparse matrix? Brief it with an example. Write a C program to check whether input matrix is a sparse or not	CO2	L2
8	What are polynomials? Brief it with an example. Write a C program to add two polynomials	CO2	L3
9			
10			
e	**Experiences**	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

Module – 2

Title:	Stack And Queues ,Recursion	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Compare the stack and queues concept using static and dynamic allocations	CO3	L3
2	Analyze by solving mathematical aspects using recursion methods	CO4	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
11	Stacks: Definition, Stack Operations,	CO3	L3

12	Array Representation of Stacks, Stacks using Dynamic Arrays,		
13	Stack Applications: Polish notation, Infix to postfix conversion,evaluation of postfix expression,		
14	Queues: Definition, Array Representation,		
15	Queue Operations, Circular Queues, Circular queues using Dynamic arrays,		
16	Dequeues, Priority Queues, A Mazing Problem.		
17	Multiple Stacks and Queues. Programming Examples.		
18	Recursion - Factorial, GCD,	CO4	L3
19	Fibonacci Sequence,		
20	Tower of Hanoi,Ackerman's		
c	**Application Areas**	**CO**	**Level**
1	Able to differentiate stacks and queue data structure	CO3	L3
2	Able to perform recursion operation on different problems (factorial,GCD,Fibonacci,Tower of Hanoi)	CO4	L3
d	**Review Questions**	-	-
11	Define stack and List and implement basic operations in stack using C (push, pop, isempty, isfull).Implement reversing a string using stack (array implementation) in C.	CO3	L1
12	Write a C program to implement multiple stacks using single array	CO4	L3
13	Write short notes on Applications of stack	CO3	L2
14	Write an algorithm to evaluate postfix expression. Trace the same algorithm with stack contents for the following expression A B C + * C B A - + * with A=1, B=2, C=3.	CO4	L3
15	Convert each of the following expression to its postfix and prefix forms a) (A + B) * C – D $ E * F b) A - B / C * D $ E c) (A + B) * (C + D – E) * F d) (((A + (B - C) * D) ^ E) + F)e) (a + b) * d + e / (f + a * d) + c f) ((a / (b - c + d)) * (e - a) * c) g) a / b – c + d * e – a * c	CO4	L2
17	What is recursion? Give two conditions to be followed for successive working of recursive program. Write a 'c' recursive program to solve tower of Hanoi problem.	CO3	L5
18	Write a recursive function for computing nth Fibonacci term of a Fibonacci sequence. Hence give the trace of stack contents for n=4.	CO3	L2

19	Determine what the following recursive C function computes
	int func(int n)
	{
	if(n==0)
	return 0;
	return (n+func(n-1));
	}Write an iterative function to accomplish the same.
		CO3	L3

20	What is a linear queue? What are the applications of linear queue? Implement/Write a C program to simulate the 1) insert 2) delete 3)display operations.		
e	**Experiences**	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

E1. CIA EXAM – 1

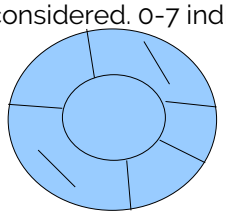
a. Model Question Paper - 1

Crs Code:	CS501PC	Sem:	I	Marks:	30	Time:	75 minutes		
Course:	Design and Analysis of Algorithms								
-	**-**	**Note: Answer any 2 questions, each carry equal marks.**					**Marks**	**CO**	**Level**
1	a	What do you mean by Data Structure? What are the various operations performed on data structures? Explain					20	CO1	L1
	b	Explain declaring pointer to structure with an example							L2
	c	Define String. Explain how a string can be declared and initialized with an example						CO2	L3
	d	List different string manipulation functions. Explain them along with syntax							L1
		or							
2	a	How do we access data members of structure and structure with a pointer? Examples?					20		L2
	b	Declare and use a data structure in C for maintaining student details							L3
	c	Illustrate string manipulation functions with examples							L3
	d								L2
3	a	What is stack? Indicate how stack is represented in C.					20	CO3	L1
	b	Show using the tabular column how the expression (a+b)*c is converted to a postfix expression according to the infix to postfix conversion algorithm						CO4	L2
	c	Write the algorithm to evaluate a valid postfix expression and hence evaluate the postfix expression 6 2 3 + - 3 8 2 / + * 1 2 3 + * 3 2 1 - + * A B + C D E - * / for A=5 B=6 C=4 D=3 E=7 6 2 3 + 3 8 2 / + * 2 $ 3 + All the operands are single digit positive integers and operators are binary in nature.							L1
	d	Write a recursive function to find the GCD of two integers.							L2
4	a	Write a recursive function fact(n) to find the factorial of an integer. Diagrammatically explain how the stacking and unstacking taking place during execution for fact(4)					20		L2
	b	What is circular queue? What ate the advantages of Circular queue over simple queue.							L2
	c	Write implementation for circular queue using array. Also write following routine of circular queue. 1) insert 2) delete 3) display							L1
	d	Explain priority queue. Explain the working of simple queue							L3

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	CS501PC	Sem:	I	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Design and Analysis of Algorithms						

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.					
SNo	**USN**	**Assignment Description**	**Marks**	**CO**	**Level**
1		Give the significance of using type definitions with structures	5	CO1	L2
2		Define Unions with an example. Compare structures and unions with an example. What are the advantages of using unions?	5	CO2	L3
3		What do you mean by self referential structures? Explain with an example. Differentiate self referential structures from ordinary structures		CO2	L3
4		Write a algorithm and function to convert a valid infix expression to postfix expression. Demonstrate the same function with example.(using stack) a) (a * b) + c / d b) (((a / b) – c) + (d * e)) - (a * c) c) a * (b + c) * d d) A $ B * C – D + E / F / (G + H) e) A – B / (C * D $ E)	5	CO1	L3
5		Write a C program to implement a two primitive operations on stack using dynamic memory allocation.			
6		What is system stack? How the control is transferred to or from the function with the help of activation records.			
7		Convert the infix expression to postfix expression and evaluate the same. a / b – c + d * e – a * c for a=6 b=3 c=1 d=2 e=4.How multiple stacks implemented using one dimensional array? Explain with suitable example.			
8		Write recursion function to find the maximum of n numbers. Write recursion function to reverse the positive integer number.			
9		Write a recursive function to implement a binary search.Write a recursive function to sum a list of numbers.			
10		For a given circular queue shown in Fig below write the values of front and rear in the table after each specified operation is performed. Queue full/empty conditions must be considered. 0-7 indicates the array indices. 			
11		Explain how would you implement a circular queue using dynamically allocated arrays.			
12					

D2. TEACHING PLAN – 2

Module – 3

Title:	Linked List	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Differentiate the stacks and queues implementations with combined arrangements using linked list	CO5	L3
2			

b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
31	Linked Lists:Definition, Representation of linked lists in Memory,	CO5	L3
32	Memory allocation; Garbage Collection.		
33	Linked list operations: Traversing, Searching, Insertion, and Deletion.		
34	Doubly Linked lists,		
35	Circular linked lists,		
36	header linked lists.		
37	Linked Stacks and Queues.		
38	Applications of Linked lists – Polynomials,		
39	Sparse matrix representation.		
40	Programming Examples		
c	**Application Areas**	**CO**	**Level**
1	Able to perform the sequential and linked storage representation of data	CO5	L3
2			
d	**Review Questions**	-	-
12	Assume a list exists. Read two numbers M and N from the list and swap them.Write a function to reverse a singly linked list.	CO5	L3
13	Write a function to print an ordered list.(The list should sort and as and when the elements are entered) . Write a function to concatenate two lists.	CO5	L3
14	Write a function to display nodes of a DLL in reverse order. Write a function to delete all nodes in SLL and DLL.	CO5	L3
15	Give differences between SLL and DLL.Explain in detail the merits and demerits of linked lists	CO5	L3
16	Distinguish arrays and linked lists Explain advantages of circular lists with respect to other lists.	CO5	L3
17	What is the use of header node in a list. Explain with examples.	CO5	L3
18			
19			
e	**Experiences**	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

Module – 4

Title:	Tree	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Apply binary tree on arrays and linked list for binary tree traversal	CO6	L3
2	Analyze the data hierarchy for mathematical expression	CO7	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
31	Trees: Terminology, Binary Trees,	CO6	L3
32	Properties of Binary trees,		
33	Array and linked Representation of Binary Trees,		
34	Binary Tree Traversals – Inorder, postorder, preorder;	CO7	L3

35	Additional Binary tree operations.		
36	Threaded binary trees,		
37	Binary Search Trees – Definition,Insertion, Deletion, Traversal,		
38	Searching,		
39	Application of Trees- Evaluation of Expression,		
40	Programming Examples		
c	**Application Areas**	**CO**	**Level**
1		CO6	L3
2		CO7	L3
d	**Review Questions**	-	-
12	Define the following: i) Binary tree ii) Complete BT iii) Almost Complete BT iv)Binary Search Tree v)Depth of a tree vi)Sibling	CO6	L1
13	In brief describe any five applications of tree. What are the different ways of representing a tree? Explain with example	CO6	L3
14	What are the different ways of representing a Binary tree? Explain with example	CO6	L2
15	Write a function to sort the elements in a BST. Explain the different methods in which a binary tree can be represented? Give the advantages and disadvantages of each?	CO6	L3
16	Write C functions for the following tree traversals: i) Inorder ii)Preorder iii)Postorder	CO7	L2
17	Construct a binary tree from the given preorder and inorder sequence: Preorder: A B D G C E H I F Inorder: D G B A H E I C F	CO7	L5
18			
19			
e	**Experiences**	-	-
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	CS501PC	Sem:	I	Marks:	30	Time:	75 minutes
Course:	Design and Analysis of Algorithms						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Write all four functions to implement circular DLL using header.	20	CO5	L1
	b	Describe DLL with advantages and disadvantages. Write C function to delete a node from DLL, ptr is a pointer which points to the node to be deleted. Assume that there are nodes on either side of the node to be			L2

		deleted.			
	c	Demonstrate queue and stack using singly linked list		CO6	L3
	d				L1
2	a	Explain how a chain can be used to implement a queue. Write the functions to insert and delete elements from such queue.	20	CO7	L2
	b	Write functions for the following a. To find length of the list b. To display odd and even numbers in the list c. To add odd & even numbers in the list d. To search a given node in the list			L3
	c	Create SLL of integers and write C functions to perform the following a. Create a node list with data 10,20 and 30 b. Insert a node with value 15 in between 10 and 20 c. Delete the node whose data is 20 d. Display the resulting SLL			L3
	d				L2
3	a	Construct an Expression tree for the expression A / B + C * D + E. Give algorithm for TTT and apply the same to the above expression.	20	CO8	L1
	b	Prove that max no of nodes in a BT of depth K is 2 k – 1.Max no of nodes on level i of a BT is 2 i-1,given that i>=1 (or)2i given that i>=0		CO8	L2
	c	Prove that no of leaf nodes = no of nodes of degree-2 (or) for any nonempty Binary Tree T, if N0 is the no of leaf nodes and N2 no of nodes of degree 2 then N0 = N2 +1.			L1
	d				L2
4	a	Construct BST for the following: 22, 28,20,25,22,15,18,10,14.	20		L2
	b	Write recursive functions for the following operations on BST: i) Insert_key() ii)Delete_key() iii) Search_key()			L2
	c				L1
	d				L3

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	CS501PC	Sem:	I	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Design and Analysis of Algorithms						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		7. Write operations for SSL, DLL CSLL & CDLL a. Insertfront() b. InsertEnd() c. Insert_Bef_Key d. Insert_aft_Key()e. Del_front() f. Del_End() g. Del_Key()	5	CO8	L2
2		Write operations for CSLL & CDLL a. Insertfront() b. InsertEnd() e. Del_front() f. Del_End()	5	CO9	L3
3		19. For the given sparse matrix and its transpose give the triplet representation using 1D array. A will be its given matrix and B will be its transpose. A = 15 0 0 22 0 -15 0 11 3 0 0 0 0 0 0 -6 0 0 0 0 0 0 0 0 91 0 0 0 0 0 0 0 28 0 0 0		CO10	L3
4		Consider two polynomials A(x) = 2x1000 + 1 and B(x) = x4 + 10x3 + 3x2 +1, show diagrammatically how these two polynomials can be stored in a single 1-D array. Also give its C	5	CO9	L3

		representation.			
5		What is polynomial? What is the degree of polynomial? Write a function to add two polynomial.			
6		Explain different types of linked list with diagram.			
7		With node structure show how would you store the polynomials in linked list? Write C functions for adding two polynomials represented as circular lists.			
8		Write a short note on linked representation of sparse matrix and DLL			
9		What is Threaded Binary Tree? Explain its advantage over Binary Tree. Explain threaded binary tree construction with a suitable example.			
10		16.Write C functions to perform the following operations on BST (i)Count the number of nodes (ii) Find the largest and smallest element. (iii)Count and display the leaf nodes (iv)Count and display the non leaf nodes			
11					
12					

D3. TEACHING PLAN – 3

Module – 5

Title:	Graphs,Sortings,Hashing,File Structure	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Simplify the graph using Depth first search and Breadth first search Traversal methods	CO8	L3
2	Write the function for given set of values using sorting problem solving technique	CO9	L3
3	Analyze the data to be organized in table and file formate using hashing and file operations	Co10	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
41	Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs,	CO8	L3
42	Elementary Graph operations,		
43	Traversal methods: Breadth First Search and Depth First Search.		
44	Sorting and Searching: Insertion Sort, Radix sort,	CO9	L3
45	Address Calculation Sort.		
46	Hashing: Hash Table organizations, Hashing Functions,	Co10	
47	Static and Dynamic Hashing.		
48	Files and Their Organization: Data Hierarchy,		
49	File Attributes, Text Files and Binary Files, Basic File Operations,		
50	File Organizations and Indexing		
c	**Application Areas**	**CO**	**Level**
1	Able to perform the traversal methods	CO8	L3
2	Able to analyze the searching and sorting techniques	CO9	L3
	Able to implement and design the data structure in a high level langauage in organized manner	CO10	L3
d	**Review Questions**	-	-
12	What is level order traversal of a tree? Write a C function for the level	CO8	L1

	order traversal of the above graph.		
13	Construct a binary tree for the following data: 23, 67, 100, 2, 11, and 56,90,34,99. Perform all traversals of the constructed binary tree.	CO8	L3
14	Write algorithm for the following and trace for the following example 30, 10, 20, 50, 18, 40, 80 a) insertion sort b)Radix sort c)Address calculation sort d)Bubble Sort	CO8	L2
15	What is hashing? What are the different types of hash functions? Explain with an example.	CO9	L3
16	What is collision? Explain different collision resolution techniques.	CO10	L3
17			
18			
19			
e	**Experiences**	-	-
1		CO9	L3
2		CO10	L3
3		CO9	L3
4		CO10	L3
5			

E3. CIA EXAM – 3

a. Model Question Paper - 3

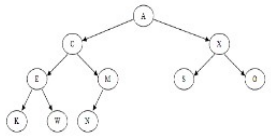
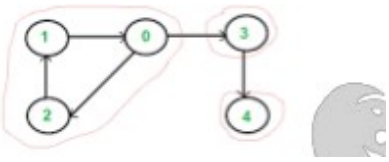
Crs Code:	CS501PC	Sem:	I	Marks:	30	Time:	75 minutes
Course:	Design and Analysis of Algorithms						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	What are pros and cons of linear probing, quadratic probing and double hashing.	20	CO9	L1
	b	What are the methods used for traversing the graph. Explain each with an example.			L2
	c	What is graph traversal. What are the graph traversal algorithms. Explain with example.		CO9	L3
	d				L1
2	a	Explain briefly different types of elementary graph operations with examples.	20	CO10	L2
	b	Explain Static hashing and dynamic hashing.			L3
	c	Write short notes on a) Directory hashing b) Directory less hashing			L3
	d				L2
3	a	Explain basic operations that can be performed on a file.	20	CO10	L1
	b	Explain indexed file organization. What are its advantages?		CO10	L2
	c	Differentiate sequential and relative file organizations. Explain with examples.			L1
	d				L2
4	a	.Write short notes and explain features, advantages and disadvantages for each the following: i) Sequential Organization ii) Relative File Organization iii) Indexed Sequential File Organization	20		L2
	b				L2
	c				L1
	d				L3

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	CS501PC	Sem:	I	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Design and Analysis of Algorithms						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		What is indexing? Explain Ordered indices, Dense & Sparse indices, Cylinder Surface indexing, Multi-level indices, Inverted indices, B-Trees indices & Hashed indices	5	CO9	L2
2		What are biconnected components? How can traversal algorithm be used to find biconnectedcomponents of a graph?	5	CO9	L3
3		What is Spanning tree of a graph? Explain with an example how a spanning tree is constructed using DFS traversal.		CO10	L3
4		What are the different file attributes? Explain.	5	CO10	L3
5		Explain the different type of indices used in indexed file organization.		CO9	L3
6		Explain the data hierarchy in a file organization.		CO10	L3
7		What is hashing? Explain the need for hashing. How does it improve access time of data?		CO9	L3
8		What are the key components of hashing? Explain with an example.		CO10	L3
9		What are the requirements that a good hashing function should satisfy? Explain.		CO9	L3
10		Explain the following terminologies with respect to a graph? ¬ Degree of a node ¬ Weighted graph ¬ Adjacency matrix ¬ Connected graph ¬ Complete graph		CO10	L3
11		Construct an inorder threaded binary tree for the following binary tree. 		CO9	L3
12		Define graph. Write the difference between graph and trees. Show the adjacency matrix and adjacency list representation for the given graph. 		CO10	L3
13					
14					
15					
16					
17					
18					

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Data Structure and Applications					Month / Year	May /2018	
Crs Code:		CS501PC	Sem:	I	Marks:	100	Time:	180 minutes	
-	**Note**	Answer all FIVE full questions. All questions carry equal marks.					**Marks**	**CO**	**Level**
1	a	What do you mean by Data Structure? What are the various operations performed on data structures? Explain					16 / 20	CO1	
	b	Explain declaring pointer to structure with an example							
	c	Define String. Explain how a string can be declared and initialized with an example						CO2	
	d	List different string manipulation functions. Explain them along with syntax							
-	a	How do we access data members of structure and structure with a pointer? Examples?					16 / 20	CO1	
	b	Declare and use a data structure in C for maintaining student details						CO2	
	c	Illustrate string manipulation functions with examples							
	d								
2	a	What is stack? Indicate how stack is represented in C.					16 / 20	CO3	
	b	Show using the tabular column how the expression (a+b)*c is converted to a postfix expression according to the infix to postfix conversion algorithm							
	c	Write the algorithm to evaluate a valid postfix expression and hence evaluate the postfix expression 6 2 3 + - 3 8 2 / + * 1 2 3 + * 3 2 1 - + * A B + C D E - * / for A=5 B=6 C=4 D=3 E=7 6 2 3 + 3 8 2 / + * 2 $ 3 + All the operands are single digit positive integers and operators are binary in nature.						CO4	
	d	Write a recursive function to find the GCD of two integers.							
-	a	Write a recursive function fact(n) to find the factorial of an integer. Diagrammatically explain how the stacking and unstacking taking place during execution for fact(4)					16 / 20	CO3	
	b	What is circular queue? What ate the advantages of Circular queue over simple queue.						CO4	
	c	Write implementation for circular queue using array. Also write following routine of circular queue. 1) insert 2) delete 3) display							
	d	Explain priority queue. Explain the working of simple queue							
3	a	Write all four functions to implement circular DLL using header.					16 / 20	CO5	
	b	Describe DLL with advantages and disadvantages. Write C function to delete a node from DLL, ptr is a pointer which points to the node to be deleted. Assume that there are nodes on either side of the node to be deleted.							
	c	Demonstrate queue and stack using singly linked list						CO6	
	d								
-	a	Explain how a chain can be used to implement a queue. Write the functions to insert and delete elements from such queue.					16 / 20	CO5	
	b	Write functions for the following a. To find length of the list b. To display odd and even numbers in the list c. To add odd & even numbers in the list							

		d. To search a given node in the list			
	c	Create SLL of integers and write C functions to perform the following a. Create a node list with data 10,20 and 30 b. Insert a node with value 15 in between 10 and 20 c. Delete the node whose data is 20 d. Display the resulting SLL		CO6	
	d				
4	a	Construct an Expression tree for the expression A / B + C * D + E. Give algorithm for TTT and apply the same to the above expression.	16 / 20	CO7	
	b	Prove that max no of nodes in a BT of depth K is 2 k – 1.Max no of nodes on level i of a BT is 2 i-1,given that i>=1 (or)2i given that i>=0			
	c	Prove that no of leaf nodes = no of nodes of degree-2 (or) for any nonempty Binary Tree T, if N0 is the no of leaf nodes and N2 no of nodes of degree 2 then N0 = N2 +1.		CO8	
	d				
-	a	Construct BST for the following: 22, 28,20,25,22,15,18,10,14.	16 / 20	CO7	
	b	Write recursive functions for the following operations on BST: i) Insert_key() ii)Delete_key() iii) Search_key()		CO8	
	c				
	d				
5	a	What are pros and cons of linear probing, quadratic probing and double hashing.	16 / 20	CO9	
	b	What are the methods used for traversing the graph. Explain each with an example.		CO10	
	c	What is graph traversal. What are the graph traversal algorithms. Explain with example.			
	d				
	a	Explain briefly different types of elementary graph operations with examples.	16 / 20	CO9	
	b	Explain Static hashing and dynamic hashing.			
	c	Write short notes on a) Directory hashing b) Directory less hashing		C010	
	d				

2. SEE Important Questions

Course:		Data Structure Applications					Month / Year	May /2018	
Crs Code:		CS501PC	Sem:	3	Marks:	100	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-	
Module	Qno.	Important Question					**Marks**	**CO**	**Year**
1	1	What is a pointer variable? How pointers are declared & initialized in C? Can we have multiple pointer to a variable? Explain Lvalue and Rvalue expression.					16 / 20		2014/ 15
	2	Give atleast 2 differences between : i. Static memory allocation and dynamic memory allocation. ii. Malloc() and calloc().							2014/ 15
	3	What is dangling pointer reference & how to avoid it?							2014
	4	With suitable example, explain dynamic memory allocation for 2-D arrays.							2014/ 16
	5	Define a structure for the employee with the following fields: Emp_Id(integer), Emp_Name(string), Emp_Dept(string) & Emp_age(integer) Empid, DOJ (date,month,year) and salary (Basic,							20014 /16

		DA,HRA). Write the following functions to process the employee data: (I) Function to read an employee record. (ii) Function to print an employee record.			
2	1	Define Recursion. What are the various types of recursion? Give two conditions to be followed for successive working of recursive program. Give recursive implementation of binary's search with proper comments.	16 / 20		2014/ 15/16
	2	Write an algorithm to convert a valid infix expression to a postfix expression. Also evaluate the following suffix expression for the values: A=1 B=2 C=3.AB+C-BA+C$- and convert i) a*(b+c)*d ii) (a+b)*d+e/(f+a*d)+c iii) ((a/(b-c+d))*(e-a)*c) iv) a/b-c+d*e-a*c iv) (a*b) +c/d v) ((a/b)c)+(d*e)) (a*c) to postfix.			2014/ 15/16
	3	What is the advantage of circular queue over ordinary queue? Mention any 2 applications of queues. Write an algorithm CQINSERT for static implementation of circular queue.			2009
	4	Define stack. Implement push & pop functions for stack using arrays.			2014/ 15
	5				2004
3	1	List out any two applications of linked list and any two advantages of doubly linked list over singly linked list.	16 / 20		2014/ 15/16
	2	Write short note on circular lists. Write a function to insert a node at front and rear end in a circular linked list. Write down sequence of steps to be followed.			2015
	3	Write the following functions for singly linked list: i) Reverse the list ii)Concatenate two lists.			2014/ 15/16
	4	Write the node structure for linked representation of polynomial. Explain the algorithm to add two polynomial represented using linked lists.			2013/ 15/16
	5	What is a linked list? Explain the different types of linked list with diagram. Write C program to implement the insert and delete operation on a queue using linked list.			2014/ 15/16
4	1	Define the tree & the following i) Binary tree ii) Complete binary tree iii) Almost complete binary tree iv) Binary search tree v) Depth of a tree vi) Degree of a binary tree vii) Level of a binary tree viii) Sibling ix) Root node x) Child xi) Ancestors	16 / 20		2014/ 15/16
	2	What is threaded binary tree? Explain right in and left in threaded binary trees. Advantages of TBT over binary tree. (			2014/ 15
	3	What is a heap? Explain the different types of heap?			2016
	4				2004
	5				2007
5	1	Explain the following with an example: i) forest & its traversals. Explain the different method of traversing a tree with following tree ii) graph iii) winner tree .iv) Selelction trees (june/jul 2015).	16 / 20		2015
	2	Describe the binary search tree with an example. Write a iterative & recursive function to search for a key value in a binary search tree. Define ADT of binary search tree. Write BST for the elements { 22,28,20,25,22,15,18,10,14} {14, 5, 6, 2, 18, 20, 16, 18, -1, 21}			2014
	3	Explain selection trees, with suitable example.			2014
	4	What is a forest. With suitable example illustrate how you transform a forest into a binary tree.			2014/ 15
	5	Construct a binary tree having the following sequences.			2015