Government of Karnataka
Department of Technical Education
Bengaluru

STRUCTURE DATA	**Course Title:** Data Structures using C		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15CS41T**
	Type of Course: **Lectures, Self Study & Student Activity.**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites:

Knowledge of C programming.

Course Objectives

To study the concepts of derived data types and data structures such as linked list, stack, queue, sorting and searching techniques.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

	Course outcome	CL	Linked PO	Teaching Hours
CO1	Illustrate the concepts of pointers and dynamic memory allocation with programs.	U,A	1 to 4 and 7 to 10	08
CO2	Discuss different types of file operations and command line arguments to develop simple program. of lists and apply various operations on them.	U,A	1 to 4 and 7 to 10	06
CO3	Describe data structures and different types of linked list	U,A	1 to 4 and 7 to 10	10
CO4	Construct stacks and queues using the concept of Arrays and Linked lists.	U,A	1 to 4 and 7 to 10	10
CO5	Illustrate the use of Binary Trees and its operations.	U,A	1 to 4 and 7 to 10	08
CO6	Explain sorting and searching techniques with associated programs.	U,A	1 to 4 and 7 to 10	10
			Total sessions	52

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10

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Data Structures using C	3	3	3	3	-	-	3	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks Weightage	Marks Weightage (%)
			R	U	A	A	
I	Pointers and Dynamic Memory allocation	08	-	07	15	22	15.39
II	Files	06	-	07	10	17	11.53
III	Introduction to data structures & Linked lists	10	05	07	16	28	19.23
IV	Stack & Queues	10	-	08	20	28	19.23
V	Trees	08	-	07	15	22	15.39
VI	Sorting, Searching and Application of Data Structures	10	-	08	20	28	19.23
	Total	**52**	**05**	**44**	**96**	**145**	**100**

UNIT I : Pointers and Dynamic Memory allocation   08 Hrs

Pointers - Concept of pointers, Declaring and initializing pointers, Accessing variables using pointers, Pointer arithmetic, Pointers and arrays, Pointers and character strings, Pointers and functions, Pointer as a function argument, Pointers to function, Pointers and structures.

Dynamic Memory allocation – Introduction, Dynamic memory allocation, Allocating a block of memory: Malloc, Allocating multiple blocks of memory: Calloc, Releasing the used space: Free Altering the size of memory: Realloc

UNIT II: Files   06 Hrs

Introduction, Defining and opening a file, closing a file, Input / Output operations on files, Error handling during I/O operations, Random Access to files, Command line arguments

UNIT III: Introduction to data structures & Linked lists   10 Hrs

Introduction to data structures – Introduction, Characteristics, Types of data structures, data structure operations.

Linked lists – Introduction, Basic concept, linked list implementation, Types of linked lists, Circular linked list (no implementation), doubly linked list (no implementation).

UNIT IV: Stack & Queues	10 Hrs

Stack – Introduction, Stacks, Stack operations, stack implementations.

Queues – Introduction, Basic concept, queue operations, queue implementations, circular queue (no implementation), priority queues (no implementation), double ended queues (no implementation).

UNIT V: Tree	08 Hrs

Introduction, Basic concept, Binary tree, Binary tree representation, Binary tree traversal.

UNIT VI: Sorting, Searching and Application of Data Structures	08 Hrs

Sorting – Introduction, sorting techniques – selection sort, insertion sort, bubble sort, quick sort (no implementation), merge sort (no implementation).

Searching – Introduction, Linear search, binary search.

Application of data structure – Introduction, Applications of stack, Infix to postfix conversion, Evaluation of a postfix expression, Recursion, factorial, GCD, List application of queues, linked lists and trees.

📚Text books
1. Programming with ANSI-C, E. Balaguruswamy, Sixth Edition, Tata Mcgraw Hill *for Unit I and II*
2. Data Structures using C, E. Balagurusamy, Tata Mcgraw Hill *for Unit III,IV,V,VI*

References
1. Programming with ANSI & Turbo C, Ashok Kamthane, Second Edition, Pearson Education.
2. Let us C, Yashavant P Kanetkar, 14th Edition, BPB publication, **ISBN** 9788183331630
3. Data structures A Programming Approach with C Second Edition , PHI publication, Dharmender Singh Kushwaha, Arun Kumar Misra.
4. Programming in C and Data Structure, P.B.Kotur, Sapna Book house
5. http://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp&search_language=English
6. http://www.tutorialspoint.com/cprogramming/
7. http://www.indiabix.com/online-test/c-programming-test/

Suggested list of student activities

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
Student activity like mini-project, surveys, quizzes, etc. should be done in group of 3-5 students.

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1.   Each group should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme coordinator.

2**.**   Each group should conduct different activity and no repeating should occur

1	Implementation of Double linked list and circular linked list
2	Implementation of Circular Queue
3	Implementation of function pointers
4	Design and implement the Applications of Stack
5	Quiz

Course Delivery

The course will be delivered through lectures and Power point presentations/ Video

Course Assessment and Evaluation Scheme

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1 to 6
				Student activities	05	Report	1 to 6
				Total	**25**		
	SEE	End Exam		**End of the course**	**100**	Answer scripts at BTE	1 to 6
Indirect Assessment			Students	Middle of the course		Feedback forms	1, 2, 3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1 to 6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off

to the next higher digit.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	%
1	Remembrance	10
2	Understanding	50
3	Application	40

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 AM	IV SEM	Data Structures Using C	20
	Year: 2015-16	Course code:15CS41T	

Name of Course coordinator :
Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	CL	CO	PO
1	How is a pointer to an array different from an array of pointers? Explain with an example (5)	U	1	1,2
2	Write C program to swap two numbers using pointers. (5) OR Give the difference between call-by-value and call-by-reference methods.	A	1	1,2
3	Explain different file accessing modes. OR With an example, explain how to handle errors during I/O operations	U	2	1,2
4	Write a program to copy contents of one file to another.	A	2	1,2

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Format for Student Activity Assessment

DIMENSION	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collects some basic information; refer to the topic	Collects relevant information; concerned to the topic	Collects a great deal of information; all refer to the topic	3
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs all duties	Performs all duties of assigned team roles with presentation	4
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Does the assigned job without having to be reminded.	Always does the assigned work without having to be reminded and on given time frame	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Listens, but sometimes talk too much	Listens and contributes to the relevant topic	Listens and contributes precisely to the relevant topic and exhibit leadership qualities	3
					TOTAL	**13/4=3.25=4**

All student activities should be done in a group of 4-5 students with a team leader.

Diploma in Computer science & Engineering
IV- Semester
Course Title: Data Structures Using C

Time: **3 Hours**   Max Marks**: 100**

PART-A

Answer any <u>SIX</u> questions. Each carries 5 marks.   5X6=30 Marks

1. Explain fseek() and ftell() functions.
2. Define Data structures. Mention different types of data structures.
3. Write the advantages and disadvantages of a Linked List.
4. Define stack. Explain how to represent a stack in C.
5. Write a note on dequeue.
6. Define the following a)internal node b) sibling c) degree of the tree d) depth of a tree
    e) path
7. Define the following a) root node b) leaf node c) level of tree d) child node e)parent
    node.
8. Write a recursive C program to find the GCD of two numbers.
9. List the application of Linked List.

PART-B

Answer any <u>SEVEN</u> full questions each carries 10 marks.   10X7=70 Marks

1. a)Define Pointer. Write its advantages and disadvantages.
    b)Explain pointer to structure with example.
2. List and explain Dynamic Memory allocation functions in C.
3. Write a program to copy contents of one file to another. Use command line arguments
    to specify the file names.
4. Write the c functions to perform insert at front and delete operations on Singly Linked
    List.
5. Define Circular Linked List. Give its c representation.
6. Write C program to implement push and pop operation of stack.
7. Define Priority queue. Write the C implementation Priority Queue.
8. Construct a binary tree for the following values and traverse the tree in preorder,
    inorder and postorder:
        46, 76, 36, 26, 16, 56, 96
9. Write a c program to implement Binary Search.
10. List the application of stack. Write an algorithm to convert infix to postfix expression.

Diploma in Computer Science & Engineering
IV Semester
Course Title: Data Structures Using C

CO	Question	CL	Marks
I	Define Pointer. Write its advantages and disadvantages.	A	05
	Explain the declaration and initialization of pointer variable with an example.	U	
	Discuss the use of address operator and indirection operator with pointers.	U	
	Explain the array of pointers with an example.	U	
	Give the difference between call-by-value and call-by-reference methods.	U	
	Differentiate between pointers as function arguments and pointers to function.	A	
	How is a pointer to an array different from an array of pointers? Explain with an example	U	
	Explain pointers and array using example.	U	
	Explain how an array can be passed to a function?	A	
	Explain in brief the different parameter passing mechanisms.	A	
	Explain pointer to structure with example.	A	
	Write C program to swap two numbers using pointers.	A	
	Define Dynamic Programming in C and its advantages.	A	
	Give the difference between malloc() and calloc() functions.	U	
	Explain free(). What are its advantages?	U	
	Explain character pointer as an argument to a function with an example.	U	10
	Discuss pointer as a function argument. With an example explain call-by-reference method.	A	
	With an illustration program explain pointers to structures.	A	
	With an illustration program explain pointers to arrays.	A	
	Write a program to illustrate pointer arithmetic's.	A	
	Write C program to compare 2 strings to check whether they are equal or not using pointer.	A	
	What are the advantages of pointer? Write a program using pointers to compute the sum of all elements stored in an array.	A	
	Explain Dynamic Memory allocation in C using memory map.	A	
	List and explain Dynamic Memory allocation functions in C.	A	
	Writ a program to illustrate memory allocation using malloc() function.	A	
	Writ a program to illustrate memory allocation using calloc() function.	A	
	Writ a program to illustrate reallocation of memory using realloc() function.	A	
	How are static and dynamic memory allocations different? Write a program to sort 10 numbers using malloc().	A	
	What is a file? Explain how to open and close a file.	U	
	Distinguish between the following functions: i. getc and getchar	R	

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	ii. printf and fprintf		05
	With an example, explain how to handle errors during I/O operations.	U	
	Explain fseek() and ftell() functions.	U	

II	Differentiate between following functions:
	    i. feof and ferror
	    ii. printf and fprintf
	    iii. getc and getw
		U	10

	Write a program to copy contents of one file to another.	A	
	Use command line arguments to specify the file names.	U	
	List and explain Input /Output functions of file.	U	
	Explain different file accessing modes.	U	
III	Define Data structures. Mention different types of data structures.	R	05
	What are primitive data types? Explain	U	
	Distinguish between linear and non-linear data structures.	R	
	Explain data structure operations.	U	
	Define Linked List. Mention the different types of Linked list.	R	
	Explain the representation of a Linked List in memory with a help of an illustration.	U	
	Explain the operations that are performed on Singly Linked List.	U	
	Write the advantages and disadvantages of a Linked List.	U	
	Compare Singly Linked List with Circular Linked List.	U	
	Compare Singly Linked List with Doubly Linked List.	U	
	Write the c functions to perform insert at end and display operations on Singly Linked List.	A	10
	Write the c functions to perform insert at front and delete operations on Singly Linked List.	A	
	Write the c functions to perform insert at a given position operations on Singly Linked List.	A	
	Define Circular Linked List. Give its C representation.	A	
	Define Doubly Linked List. Give its C representation.	A	
IV	Define stack. Explain how to represent a stack in C.	U	05
	Explain push and pop operations of stack.	A	
	Define queue. Explain the sequential representation of queue	U	
	Write a note on queue.	U	
	Define Priority queue. Differentiate ascending ord descending priori queue	A	
	Write C program to implement push and pop operation of stack.	A	10
	Define queue. List and explain types of queues.	U	
	Write a program to implement queue in C.	A	
	Write an algorithm to perform Queue insertion and deletion.	A	
	Define Circular queue. Write the C implementation Circular Queue.	A	
	Define Priority queue. Write the C implementation Priority Queue.	A	
	Define Double Ended queue. Write the C implementation Double Ended Queue double.	A	
	Define Binary tree. Explain the method of representing binary trees.	U	

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	Explain with an example how to perform deletion operation on a binary tree.	A		
	Define the following a) root node b) leaf node c) level of tree d) child node e)parent node.	R		
	Define the following a)internal node b) sibling c) degree of the tree d) depth of a tree e)path	R	05	
V	Construct a binary tree for the following data, 16, 3, 8, 11, 1, 6, 9, 14, 2, 10, 17, 7 13	A		
	Explain Strictly Binary tree and Complete Binary Tree, with an example.	A		
	Explain Perfect Binary tree and Balanced Binary Tree, with an example.	A		
	What is binary tree traversing? Explain type of traversal with example.	A		
	Develop a recursive algorithm to traverse a binary tree in the following order i.e Inorder, Preorder and Post order.	A	10	
	Construct a binary tree for the following values and traverse the tree in preorder, inorder and postorder: 46, 76, 36, 26, 16, 56, 96	A		
	Define tree traversal. List and explain types of tree traversal.	A		
	Explain with an example the working of the merge sort.	A		
	Explain the concept of straight selection sort.	U		
	Write a note on simple insertion sort.	U		
	Explain Quick sort with example.	A		
	Explain Bubble sort with an example.	A		
	Explain the concept of Linear Search.	U		
	Explain the concept of Binary Search.	U	05	
	Write a recursive C program to find the GCD of two numbers.	A		
	Write a recursive C program to find the Factorial of a number.	A		
	What is recursion? Explain the properties of recursive definition	U		
VI	List the application of Queues.	A		
	List the application of Linked List.	A		
	List the application of Trees.	A		
	Develop a C program to implement bubble sort method.	A		
	Write a program to implement Insertion sort.	A		
	Write a program to implement Selection sort.	A		
	Write a c program to implement Linear Search.	A		
	Write a c program to implement Binary Search.	A		
	List the application of stack. Write an algorithm to convert infix to postfix expression.	A	10	
	Give the postfix and prefix forms for the following expression. (a / b) * c – (d + g) $ f	U		
	Give the postfix and prefix forms for the following expression. a $ b * c – d + e / f / (g + h)	U		
	Evaluate the given postfix expression with the stack content, **3+4*2/(9-5) ^ 4**	U		

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