FR. Conceicao Rodrigues College Of Engineering

Department of Computer Engineering

S.E. (Computer) (semester III)

(2022-2023)

Course Outcomes and Assessment Plan

Subject: Data Structures **Credits-4**

Course code: CSC303

Pre-requisite: C Programming	
Course Objectives: The course aims:	
1	To understand the need and significance of Data structures as a computer Professional.
2	To teach concept and implementation of linear and Nonlinear data structures.
3	To analyze various data structures and select the appropriate one to solve a specific real- world problem.
4	To introduce various techniques for representation of the data in the real world.
5	To teach various searching techniques.
Course Outcomes:	
1	Students will be able to implement Linear and Non-Linear data structures.
2	Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.
3	Students will be able to explain various data structures, related terminologies and its types.
4	Students will be able to choose appropriate data structure and apply it to solve problems in various domains.
5	Students will be able to analyze and Implement appropriate searching techniques for a given problem.
6	Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.

Module		**Detailed Content**	**Hours**
1		**Introduction to Data Structures**	2
	1.1	Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear and Nonlinear, Operations on Data Structures.	
2		**Stack and Queues**	8
	2.1	Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion.	
	2.2	Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Introduction of Double Ended Queue, Applications of Queue.	
3		**Linked List**	10

	3.1	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List, Singly Linked List Application-Polynomial Representation and Addition.	
4		**Trees**	11
	4.1	Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding, Search Trees-AVL, rotations in AVL Tree, operations on AVL Tree, Introduction of B Tree, B+ Tree.	
5		**Graphs**	4
	5.1	Introduction, Graph Terminologies, Representation of Graph, Graph Traversals- Depth First Search (DFS) and Breadth First Search (BFS), Graph Application- Topological Sorting.	
6		**Searching Techniques**	4
	6.1	Linear Search, Binary Search, Hashing-Concept, Hash Functions, Collision resolution Techniques	

Textbooks:	
1	Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication.
2	Reema Thareja, “Data Structures using C”, Oxford Press.
3	Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, CENGAGE Learning.
4	Jean Paul Tremblay, P. G. Sorenson, “Introduction to Data Structure and Its Applications”, McGraw-Hill Higher Education
5	Data Structures Using C, ISRD Group, 2nd Edition, Tata McGraw-Hill.
References:	
1	Prof. P. S. Deshpande, Prof. O. G. Kakde, “C and Data Structures”, DreamTech press.
2	E. Balagurusamy, “Data Structure Using C”, Tata McGraw-Hill Education India.
3	Rajesh K Shukla, “Data Structures using C and C++”, Wiley-India
4	GAV PAI, “Data Structures”, Schaum’s Outlines.
5	Robert Kruse, C. L. Tondo, Bruce Leung, “Data Structures and Program Design in C”, Pearson Edition

Course Outcomes:

At the end of the course students will be able to:

CSC303.1	Implement various linear data structures.	(Application)
CSC303.2	Implement various non linear data structures.	(Application)
CSC 303.3	Implement appropriate searching techniques for a given problem.	(Application)
CSC 303.4	Choose appropriate data structure and apply it to solve problems in various domains	(Application)

Program Outcomes (POs)

Engineering Graduates will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling of complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognized the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(A) **Program Specific Outcomes (PSOs)**

Student will have ability to

PSO1: Develop Artificial Intelligence and Machine Learning based systems.
PSO2: Apply cyber security mechanisms to ensure the protection of Information Technology assets.

Mapping of CO and PO/PSO

Relationship of course outcomes with program outcomes: Indicate 1 (low importance), 2 (Moderate Importance) or 3 (High Importance) in respective mapping cell.

	PO1 (Engg Know)	PO2 (Analysis)	PO3 (Design)	PO4 (investiga)	PO5 (tools)	PO6 (engg Soci)	PO7 (Env)	PO8 (Eth)	PO9 (ind Team)	PO10 (comm.)	PO11 (PM)	PO12 (life Long)	PSO 1	PSO2
CSC303.1	3												2	
CSC303.2	3												2	
CSC303.3	3	1											2	
CSC303.4	3	3	2										2	
Course To PO	3	2	2											

CO Assessment tools:

1) CSC305.1 Implement various linear data structures.

Direct Method	**Weightage**	**Target**	
Unit Test 1	0.2	60% of students will minimum score 60% marks	
University Exam (Theory)	0.25(TH)	60% of students will minimum score 60% marks	
University Exam (Practical)	0.25(PR)	60% of students will minimum score 60% marks	
Assignment 1	0.1	65% of students will minimum score 60% marks	
Lab Performance	0.2	60% of students will minimum score 60% marks	
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.1:

a) **Direct Methods (80%):** Unit Test 1+ UniExam+ Assignment+ Lab performance

CSC305.1dm = 0.2UT1 + 0.25UniexamTH+0.25UniexamPR+ 0.1Assignment +0.2Lab

b) **InDirect Methods(20%):** Course exit survey

CSC305.1*idm*

CSC305.1 = 0.8* CSC305.1dm + 0.2* CSC305.1idm

2) CSC303.2 Implement various non linear data structures. Target: 2.5

Direct Method	**Weightage**	**Target**	
Unit Test 2	0.2	60% of students will minimum score 60% marks	
University Exam (Theory)	0.25(TH)	60% of students will minimum score 80% marks	
University Exam (Practical)	0.25(PR)	60% of students will minimum score 60% marks	
Lab Performance	0.2	60% of students will minimum score 60% marks	
Assignment 2	0.1	65% of students will minimum score 60% marks	

Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.2:

a) **Direct Methods (80%):** Unit Test 2+ UniExam+ Assignment+ Lab performance

CSC305.2dm = 0.2UT2 + 0.25UniexamTH+ 0.1Assignment +0.2Lab+0.25UniexamPR

b) **InDirect Methods(20%):** Course exit survey

CSC305.2*idm*

CSC305.2 = 0.8* CSC305.2dm + 0.2* CSC305.2idm

3) CSC303.3. Implement appropriate searching techniques for a given problem.

Target: 2.7

Direct Method	**Weightage**	**Target**	
Unit Test 2	0.2	60% of students will minimum score 60% marks	
Assignment 2	0.1	60% of students will minimum score 60% marks	
University Exam (Theory)	0.25(TH)	60% of students will minimum score 60% marks	
University Exam (Practical)	0.25(PR)	60% of students will minimum score 60% marks	
Lab Performance	0.2	60% of students will minimum score 60% marks	
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.3: Implement appropriate searching techniques for a given problem.

a) **Direct Methods (80%):** Unit Test 2+ UniExam+ Assignment+ Lab performance

CSC305.2dm = 0.2UT2 + 0.25UniexamTH+ 0.1Assignment +0.2Lab+0.25UniexamPR

b) **InDirect Methods(20%):** Course exit survey

CSC305.3*idm*

CSC305.3 = 0.8* CSC305.3dm + 0.2* CSC305.3idm

4) CSC303.4 Choose appropriate data structure and apply it to solve problems in various domains

Target: 2.8

Direct Method	**Weightage**	**Target**	
UT1	0.25	60% of students will minimum score 60% marks	
Assignment 1	0.25	60% of students will minimum score 60% marks	
University Exam (Theory)	0.25(TH)	60% of students will minimum score 60% marks	
University Exam (Practical)	0.25(PR)	60% of students will minimum score 60% marks	
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.4:

c) **Direct Methods (80%):** Unit Test 1+ Uni Exam(Theory)+ Uni Exam(Practical)+ Assignment

CSC305.2dm = 0.25*UT1 + 0.25*UniexamTH+ 0.25*UniexamPR+ 0.25*Assignment

a. **InDirect Methods(20%):** Course exit survey

CSC305.4*idm*

CSC305.4 = 0.8* CSC305.4dm + 0.2* CSC305.4idm

Course Outcomes Target:

CSC 303.1	Implement various linear data structures. **Target level: 2.5**
CSC 303.2	Implement various nonlinear data structures. **Target level:2.5**
CSC 303.3	Implement appropriate searching techniques for a given problem. **Target level: 2.7**
CSC 303.4	Choose appropriate data structure and apply it to solve problems in various domains **Target level: 2.8**

CO Attainment of previous years

Course Outcomes	2021-22	2020-21
CSC 305.1: Implement various linear data structures.		2.48
CSC 305.2: Implement various nonlinear data structures.		2.28
CSC 305.3 Implement appropriate searching techniques for a given problem		2.28
CSC 305.4: Choose appropriate data structure and apply it to solve problems in various domains		2.28

Rubrics for Lab Experiments:

Sr. No	Performance Indicator	Excellent	Good	Satisfactory	Unsatisfactory
1)	Completeness and correctness [4]	Well commented and formatted, program functions correctly for all input cases. [4M]	Comparatively less use of comments, Inconsistent formatting. Program functions correctly for all input cases.[3M]	Inconsistent comments and formatting. Program functions correctly for most of the input cases.[2M]	Improper formatting, No comments. Program functions correctly for very limited cases [1M]
2)	Efficiency [3]	The code could be reused as a whole or each routine could be reused. It is readable and easy to understand [3M]	Most of the code could be reused in other programs. It is fairly readable and easy to understand [2M]	Only Some parts of the code could be reused in other programs. The code is unnecessarily long and repeated. [1M]	The code lacks reusability. It is huge and repeated at many places[0M]
3)	Post Lab Questions [2]	Answers to all questions are correct and explained in depth. [2M]	Answers to most of the questions are correct but not explained in much depth. [2-1.5M]	Answers of few questions are incorrect and lacks sufficient depth [0-1M]	Answers to most of the questions are incorrect and not explained in depth. [0 mark]
4)	Promptness [1]	The laboratory report is submitted on time [1 mark]	The laboratory report is submitted next day. [0.5 marks]	The laboratory report is submitted in next practical session. [0 marks]	

Rubrics for Assignments:

Performance Indicator	Excellent	Good	Below average
Timeline(2)	submitted on time or early (2)	Submitted next day (1)	Submitted in same week (0.5)
Organization (2)	Well organized, neat and clear handwriting, easy to read.(2)	Organized to some extent, handwriting is neat(1)	Poorly organized(0.5)
Level of content (4)	All points are covered and answered accurately (4)	Some important points are omitted /addressed minimally (3)	Many important points are missing and the answers are not accurate. (2)
Depth and breadth discussion (2)	Each point is illustrated in depth with proper justification wherever required (2)	Few points are not illustrated in depth and have minimal justification (1)	Many points are not illustrated in depth and justification missing.(0.5)

Lesson Plan: DS

Semester III **Year: 2022-23**

Modes of Content Delivery:

I	Class Room Teaching	v	Self Learning Online Resources	Ix	Industry Visit
Ii	Tutorial	vi	Slides	X	Group Discussion
Iii	Remedial Coaching	vii	Simulations/Demonstrations	xi	Seminar
Iv	Lab Experiment	viii	Expert Lecture	xii	Case Study

No of Lectures Planned: 40

No of Lectures Conducted: 31 (3 lectures per week)

Sr. No.	Planned Date	Actual Date	Topic	Delivery Mechanisms
1	25/7/2022	25/7/2022	Syllabus Discussion and Introduction to Data Structure	Classroom teaching
2	26/7/2022	26/7/2022	Introduction to Stack, queue, linked list and tree	PPT presentation in classroom
3	27/7/2022	27/7/2022	Introduction to Graph,Tree, Introduction to Abstarct Data Type, Stack ADT,	PPT presentation in classroom
4	28/7/2022	28/7/2022	Pointers in C, passing array to function, passing structure to function. Pointer to the array, pointer to the structure, pointer to the string	Classroom teaching, Self learning online resources
5	01/8/2022	01/8/2022	implementation of stack using array (without structure , with structure)	Demonstration of program using CodeBlocks in classroom
6	02/08/2022	02/08/2022	Apllications of Data Structures: Well form-ness of Parenthesis, Recusrsion	PPT presentation in classroom
7	04/08/2022	05/08/2022	Infix to Postfix conversion and examples on it.	PPT presentation in classroom
8	08/08/2022	5/08/2022	Implementation of Infix to Postfix	Demonstration of program using CodeBlocks in classroom
9	11/08/2022	8/8/2022	Algorithm and implementation of Evaluation of postfix expression with examples.	Classroom teaching using black board
10	18/08/2022	18/8/2022	Queue-Introduction, Representation using array and implementation of queue using array.	Classroom teaching using black board
11	22/08/2022	11/8/2022	Circular queue, implementation and applications of circular queue	Classroom teaching using black board
12	23/08/2022	18/8/2022	Double ended queue: Introduction, applications, Algorithm of insert and remove in Doble ended queue.	Classroom teaching using black board
13	25/08/2022	22/08/2022	Implementation of Deque, Priority queue, applications of it.	Classroom teaching using black board, Self learning online resources
14	29/08/2022	22/08/2022	Implementation of Deque, Priority queue, applications of it…..continued	Classroom teaching using black board, Self learning online resources
15	30/08/2022	23/08/2022	Intoduction to Linked List, Difference between static and dynamic memory allocation.	Classroom teaching using black board

16	05/09/2022	23/08/2022	Types of linked list, Singly, Circular and Doubly Linke List.	Classroom teaching using black board
17	06/09/2022	25/08/2022	Linked List: Introduction, Create_node() function of linked list	Classroom teaching using black board
18	08/09/2022	25/08/2022	Insert_end and insert_begin in linked list	Classroom teaching using black board
19	12/09/2022	29/08/2022	insert_begin, insert_pos, remove_first node functions in linked lkist	Classroom teaching using black board
20	13/09/2022	30/08/2022	Remove a.last node, b. node at specific position, c. split, d.concatenate etc opertaions on linked list	Classroom teaching using black board
21	15/09/2022	08/09/2022	Revision of all previous operations	Classroom teaching using black board
22	19/09/2022	12/09/2022	Concatenate, create_linked_list, copy and reverse function on linked list	Classroom teaching using black board
23	20/09/2022	13/09/2022	Operations on circular linked list	Classroom teaching using black board
24	22/09/2022	15/09/2022	Doubly Linked list and implementation of all operations on it.	Classroom teaching using black board,
25	26/09/2022	20/09/2022	Applications of linked list, introduction to Tree data structure, basic terminologies in tree data structure.	Classroom teaching using black board
26	27/09/2022	22/09/2022	Binary tee representations, tree traversal techniques, construction of binary tree from given traversal sequences,	PPT presentation in classroom
27	29/09/2022	26/09/2022	Definition of Binary search Tree, algorithm for insert and search operation, Construction of BST.	Classroom teaching using black board
28	03/10/2022	27/09/2022	Insert, Search operation in BST	PPT presentation in classroom
29	04/10/2022	29/09/2022	Delete operation with all four cases, count leaf nodes, count non leaf nodes in BST,	Classroom teaching using black board
30	06/10/2022	03/10/2022	AVL Search Tree, Rotations like Rotate left and rotate right, practice problems on AVL	Classroom teaching using black board
31	10/10/2022	04/10/2022	Practice problems on AVL tree, rotations in AVL	Classroom teaching using black board, Self learning online resources for B Tree and B+ Tree
32	11/10/2022	6/10/2022	Huffman Encoding, B-Tree and B+ Tree, Graph: Introduction, Basic terminologies, Graph representations	Black board, Online study material made available for students on classroom.
33	13/10/2022	10/10/2022	Graph traversal algorithms with examples, DFS and BFS,	Black board, PPT.
34	17/10/2022	11/10/2022	Topological sort, applications of graph, practice questions on topological sort, DFS and BFS	Classroom teaching using black board
35	18/10/2022	13/10/2022	Binary search and hashing: introduction, collision resolution techniques: separate chaining	Classroom teaching using black board
36	20/10/2022	14/10/2022	Collision Resolution Technique, Open Addressing: Linear Probing	Classroom teaching using black board
37	24/10/2022	14/10/2022	Quadratic Probing, Double hashing	Classroom teaching / Online Class
38	25/10/2022	14/10/2022	B Tree and B+ Tree Revision	Online class, Online resources provided

39	27/10/2022	14/11/2022	Discussion on 1. Previous years question papers, 2. how to write answers in exam and students query solving	Online class in the evening
40	31/10/2022	14/11/2022	Revision and Doubt solving session	Online class in the evening
Remedial classes				
41	01/11/2022	09/11/2022	Revision, doubt solving and discussion on topics given by students.	Classroom teaching using black board
42	03/11/2022	09/11/2022	Revision, doubt solving and discussion on topics given by students.	Classroom teaching using black board

Subject: Data Structures Lab **Credits-1**

Course code: CSL303

Syllabus:

1) Array implementation of stack. *
2) Conversion of Infix to Postfix. *
3) Evaluation of Postfix expression.
4) Check continuity of different types of parenthesis using stack.
5) Array implementation of Queue.
6) Array implementation of Circular Queue *
7) Array implementation of Priority Queue.
8) Implementation of Singly linked list.*
9) Linked implementation of Stack.
10) Linked implementation of Queue.
11) Implementation of Circular Linked list.
12) Implementation of Doubly Linked list.
13) Implement Binary Search Tree. *
14) Implementation of Bubble Sort.
15) Implementation of Insertion Sort.
16) Implementation of Merge Sort.
17) Implementation of Quick Sort.*
18) Implementation of Binary Search.*
20) Implementation of Hashing.
21) Implementation of Depth First Search and Breath First Search.

Term Work (25M): Lab Experiments (15M) +Assignment(5M)

List of Practicals and Lab Plan

Sub: Data Structures **Year (2020-21)**

Expr No.	Name of the Experiments	CO Mapping	Weekly Plan
1	Implementation of stack using array	CSC303.1	Third Week
*1.1	Implementation of Two Stacks in one array	CSC303.1	Third Week
2	Implementations of Infix to Postfix transformation and its evaluation.	CSC303.1	Fourth Week
3	Implementation of Queue using array.	CSC303.1	Fifth Week
4	Implementations of Circular queue menu driven program.	CSC303.1	Fifth Week
5	Implementation of different operations on singly linked list. 1. Insert at begin 2. Insert at end, 3. Insert at specific position, 4. Delete end, 5. Delete begin, 6. Delete at specific position, 7. Traverse	CSC303.1	Sixth Week
6	Implementation of different operations on linked list. 1. Copy 2. Concatenate 3.Spilt 4. Reverse 5. Count number of nodes etc.	CSC303.1	Seventh Week
7	Implementation of different operations on circular linked list. 1. Insert at begin 2. Insert at end, 3. Insert at specific position, 4. Delete end, 5. Delete begin, 6. Delete at specific position, 7. Traverse	CSC303.1	Seventh Week
8	Implement Stack / Linear Queue ADT using Linked List	CSC303.1	Eighth Week
9	Implementation of BST menu driven program Operations: 1. Insert 2. Delete (all 3 cases) 3. Search 4. Traverse	CSC303.2	Ninth Week
10	Implementation of graph and its traversals, DFS and BFS	CSC303.2	TenthWeek
*11	Construction of Expression tree from a postfix expression	CSC303.2	Eleventh Week
12	Assignment No. 1	CSC303.1, CSC303.4	Sixth Week

13	Assignment No. 2	CSC303.2, CSC303.3	Twelth Week

Course Outcomes (given in syllabus):

Students will be able to:

1. Implement various linear and non linear data structures
2. Handle operations like insertion, deletion, searching and traversing on various data structures.
3. select appropriate sorting technique for given problem.
4. select appropriate searching technique for given problem.
5. Apply the learned concepts in various domains like DBMS and Compiler construction.
6. Choose appropriate data structure for specified problem domain

Content beyond syllabus: NA

ASSIGNMENT NO. 1

DATA STRUCTURES YEAR 2022-23

CLASS: S.E. (COMPUTER) (semester III) DATE: 21/09/2022

Deadline: 30/09/2022

Course outcome:

CSC305.1: CO1: Implement various linear data structures

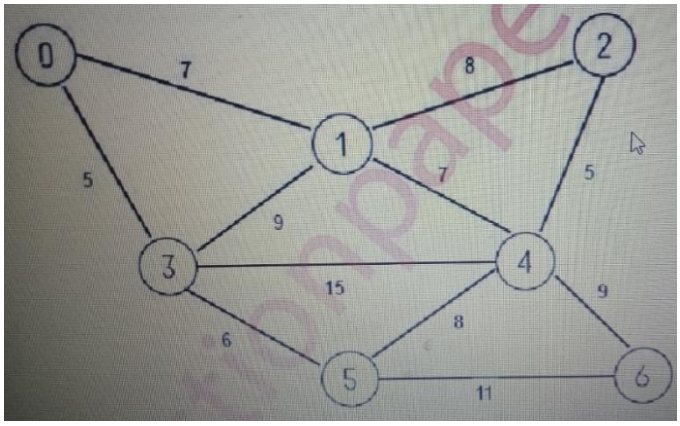
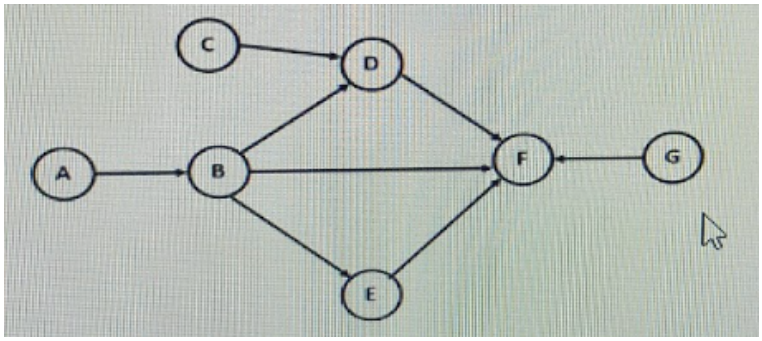
CSC305.3: CO4: Choose appropriate data structure and apply it to solve problems in various domains

Sr. No.	Question	CO	BL	PI
1	Implement a Stack data structure using two instances of Queue and queue operations allowed on the instances. Hint: newly entered element is always at the front of 'q1', so that pop operation just dequeues from 'q1'. 'q2' is used to put every new element at front of 'q1'.	CSC303.1	3	1.4.1
2	Write a program in C to implement addition of two polynomials using linked list.	CSC303.1	3	1.4.1
3	Write a C function for insertion of a node to the immediate right of a key node in a doubly linked list.	CSC303.1	3	1.4.1
4	Write a C program to add values of the nodes of a linked list, calculate the mean and display the result.	CSC303.1	3	1.4.1
5	Write a C program to add values of the nodes of a linked list, calculate the mean and display the result.	CSC303.1	3	1.4.1
6	Write a C program to implement Insert_Front and Delete_Rear on Double Ended Queue using array.	CSC303.1	3	1.4.1
7	**Explain** following data structures, related terminologies and its types. (Draw diagram, Write definition and applications) Circular queue Double ended queue Priority queue Doubly linked list	CSC303.1	2	1.4.1
8	**Choose** appropriate data structure that is best suitable for solving following problems in various domains. 1. Google maps uses this data structure for building transportation systems and their navigation system is based on the shortest path algorithm between source and destination. 2. Which data structure can be used to simulate Facebook such that users and relation between different users can be represented? 3. In World Wide Web, web pages are stored in data structure 'X'. Also if there is a link of page v on page u, this relationship is stored in 'X'. It was the basic idea behind Google Page Ranking Algorithm. 4. In Operating System, we come across Resource Allocation. Relationships between resources to the allocated process, or from requesting process to the requested resource are stored. If this leads to any formation of a cycle then a deadlock will occur. Which data structure is used to store this resource allocation?	CSC303.4	5	2.1.3

	5. In computer science, which data structure is used to represent networks of communication? 6. Which data structure is used to store hierarchical data, like folder structure, organization structure, XML/HTML data? 7. Which data structure is used in *many* search applications where data is constantly entering/leaving? 8. Which data structure is used in data compression algorithms? 9. Which data structure is used to efficiently store data in sorted form in order to access and search stored elements quickly? 10. Pragya sells footballs. She has a large container to store footballs which is closed from below. Footballs are piled one on top of the other in the box. When new balls are supplied, Pragya puts the balls in the box from the top. When a customer buys a ball, she delivers the ball at the top of the pile to the customer. Each ball has a code. She wants to store the ball codes in a data structure to keep track of her inventory. What data-structure should she use?			

ASSIGNMENT NO. 2

DATA STRUCTURES YEAR 2022-2023
CLASS: S.E. Computer (semester III) DATE: 12/10/2022
Deadline: 20/10/2022

Sr. No.	Question	CO	BL	PI
1.1	Hash the following data in a table of size 12 using separate chaining. 45, 39, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81	**CSC 303.3**	3	1.4.1
1.2	Hash the same data of question 1.1 using linear probing and quadratic probing.	**CSC 303.3**	3	1.4.1
2	Write adjacency matrix for following graph. For the following graph, show all the steps of the DFS and BFS traversal starting with vertex 1. (Present in tabular form) 	**CSC 303.2**	3	1.4.1
3	Consider the given Directed Acyclic Graph and find all possible topological orderings. 	CSC303.2	3	1.4.1
4	Construct AVL tree step by step for following key. Apply appropriate rotation if the tree becomes unbalanced. Give proper justification at each step. 10, 85, 15, 70, 20, 60, 30, 50, 65, 80, 90, 40, 5, 55	CSC303.2	3	1.4.1
5.	Inorder: 1, 2, 3, 14, 7, 10, 11, 30, 40 Postorder: 1, 3, 2, 7, 10, 40, 30, 11, 14 Construct Binary tree and write preorder of the same.	CSC303.2	3	1.4.1

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I UNIT TEST

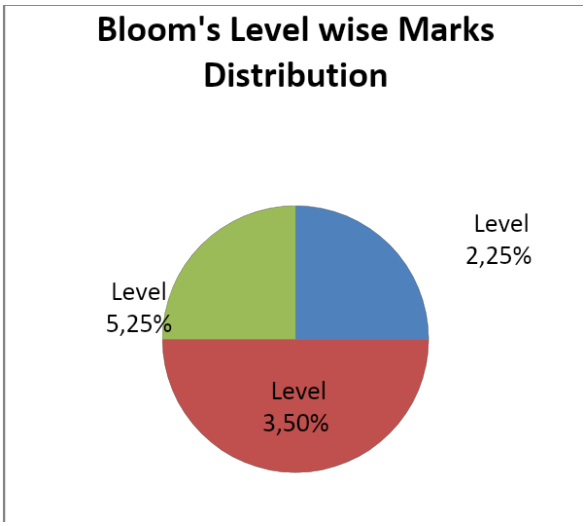
SEMESTER / BRANCH:III/COMPUTER
SUBJECT: Data Structure (DS) MAX. MARKS: 20
DATE: 06/09/22 TIMING: 1.00 pm to 2.00 pm

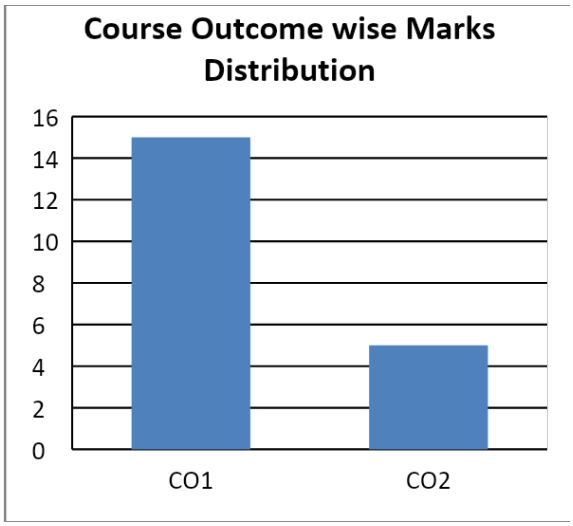
Student should be able to

CSC303.1	Implement various Linear Data Structures
CSC303.4	Choose appropriate datastructure and apply it to solveproblems in various domains

Q.NO	Questions	MARKS	CO	BL	PI
1.A	Describe Linear and non linear data structures with any two examples of each.	5	**CSC303.1**	2	1.7.1
1.B	Write a program in C to implement following operations on circular queue. 1. insert 2. remove	5	**CSC303.1**	3	1.7.1
2. A	Store student information like name, roll_no and percentage in a singly linked list. Write a program in C to implement following operation. 1. Insert new student record.	5	**CSC303.1**	3	1.7.1
	OR				
2.A	Given a stack with push(), pop(), empty() operations, delete n^{th}element of it without using any additional data structure. **(No need to define push, pop and empty)** Input : Stack[] = [1, 2, 3, 4, 5] and n=3 from top Output : Stack[] = [1, 2, 4, 5] Input : Stack[] = [1, 2, 3, 4, 5, 6] and n=4 from top Output : Stack[] = [1, 2, 4, 5, 6]	5	**CSC303.1**	3	1.7.1
2. B	Choose appropriate data structure to solve the following problem. (Write only name of the suitable data structure) 1. Simulating Undo operation in Word 2. Simulating traffic lights 3. Compiler checks mathematical expressions 4. Process scheduling in Operating system. 5. Simulating Call log in mobiles	5	**CSC303.4**	5	2.5.3

*BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)
*CO – Course Outcomes
*PO – Program Outcomes;
*PI Code – Performance Indicator Code
BL Distribution PIE chart and CO distribution bar chart (Following diagram is just for reference purpose only)


Bloom's Level wise Marks Distribution
Level 2,25%
Level 5,25%
Level 3,50%


Course Outcome wise Marks Distribution
16
14
12
10
8
6
4
2
0
CO1
CO2

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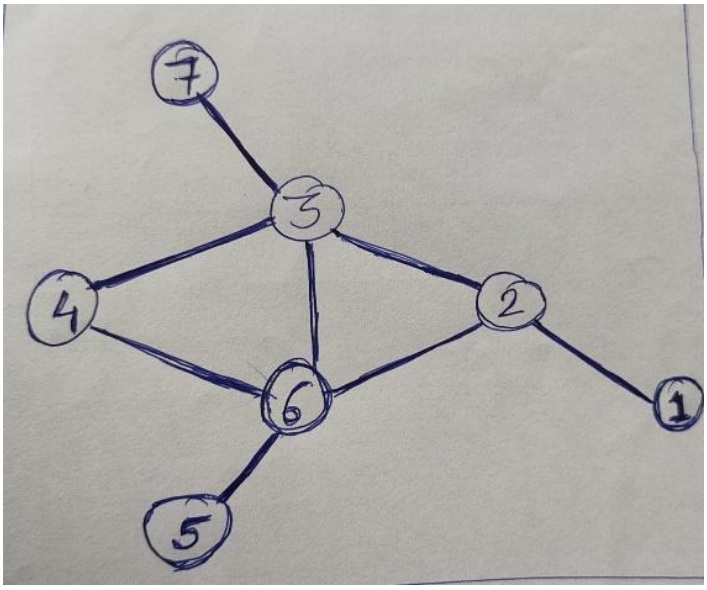
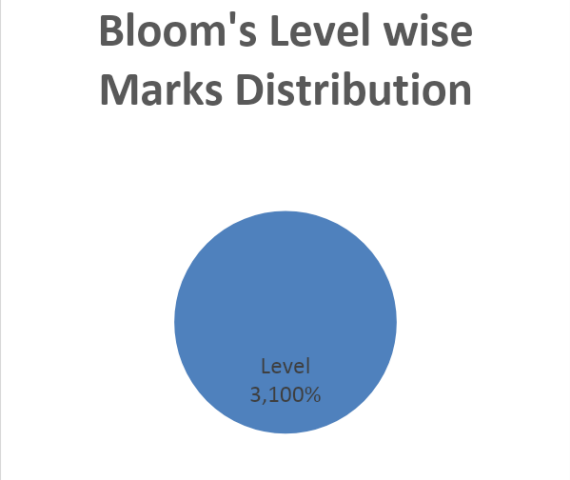
UNIT TEST II

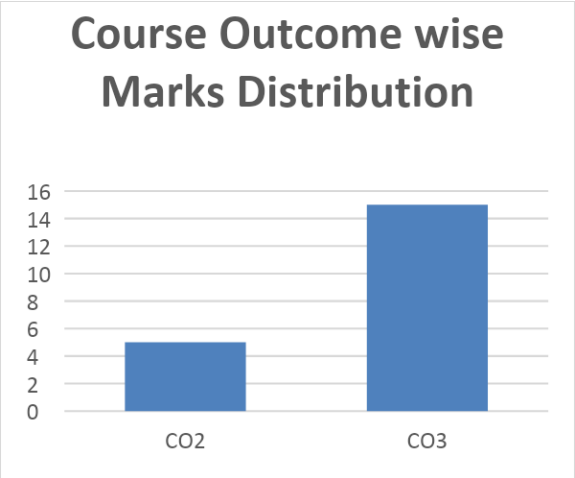
SEMESTER / BRANCH:III/COMPUTER
SUBJECT: Data Structure (DS) MAX. MARKS: 20
DATE: 18/10/2022 TIMING: 1.00 pm to 2.00 pm

CSC303.2	Implement various Non-Linear Data Structures
CSC303.3	Implement appropriate searching techniques for a given problem.

Q.No.	Questions	Marks	CO	BL	PI
Q.1	Using Linear Probing and Modulo Division method hash the following elements into a table size 11. 45, 8, 33, 85, 61, 10, 48, 76, 59	05	CO3	L3	1.4.1
Q.2	Insert following keys into AVL search tree one at a time into an initially empty AVL tree step by step. 15, 19, 22, 10, 3, 37, 25, 12, 13	05	CO2	L3	1.4.1
Q. 3	For the following graph, show all the steps of the DFS traversal starting with vertex 1. (Present in tabular form) 	05	CO2	L3	1.4.1
Q.4	Write a program in C to implement insert operation on a Binary Search Tree.	05	CO2	L3	1.4.1

*BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)
*CO – Course Outcomes
*PO – Program Outcomes;
*PI Code – Performance Indicator Code
BL Distribution PIE chart and CO distribution bar chart (Following diagram is just for reference purpose only)


Bloom's Level wise Marks Distribution
Level 3,100%


Course Outcome wise Marks Distribution
16
14
12
10
8
6
4
2
0
CO2
CO3

Action Taken for weak students:

- Two remedial classes were conducted offline for weak students to teach the important topics and solve their doubts.

Taken DSE students lectures from 21st November 2022 and conducted unit tests.