FR. Conceicao Rodrigues College Of Engineering

Department of Computer Engineering

S.E. (AI&DS) (semester III) (2022-2023)

Lesson Plan

Branch: AI&DS **Semester:III**

Subject: Data Structures **Credits-4**

Course code: CSC303

Course Title: Data Structures	SEE: 3 Hours – Theory & Oral Examination
Total Contact Hours: 36 Hours	Duration of SEE: 3 Hrs
SEE Marks: 80 (Theory) + 20 (IA)	
Lesson Plan Author:	Date:
Checked By:	Date:

Pre-requisite: C Programming

Syllabus:

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 invarious domains.
5	Students will be able to analyze and Implement appropriate searching techniques for a givenproblem.
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 DoubleEnded 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 Approachwith 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	Able to implement Linear and Non-Linear data structures.	(Application)
CSC 303.2	Able to handle various operations like searching, insertion, deletion and traversals on various data structures.	(Application)
CSC 303.3	Able to explain various data structures, related terminologies and its types.	(Application)
CSC 303.4	Able to choose appropriate data structure and apply it to solve problems in various domains.	(Application)
CSC 303.5	Able to analyze and Implement appropriate searching techniques for a givenproblem.	(Analyze and Application)
CSC 303.6	Able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.	(Analyze and 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

1. The graduate of BE in AI&DS program will have strong foundation and ability to use cutting– edge AI tools and techniques to innovate and develop new solutions.

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 (investigation)	PO5 (tools)	PO6 (engg Soci)	PO7 (Env)	PO8 (Eth)	PO9 (ind Team)	PO10 (comm.)	PO11 (PM)	PO12 (life Long)	PSO 1
CSC303.1	3												3
CSC303.2	3												3
CSC303.3	3	1											3
CSC303.4	3	3	2										3
CSC303.5	3	3											3
CSC303.6	3	3	3										3
TOTAL	18	10	5										18
Course To PO	3	2.5	2.5										3

Justification

PO1: CSC303.1, CSC303.2, CSC303.3, CSC303.4, CSC303.5 and CSC303.6 maps to PO1 because engineering graduates will be able to use linear, non-linear data structures and algorithms to provide a solution to complex engineering problems.

PO2: CSC 303.3, CSC303.4, CSC303.5 and CSC303.6 also maps to PO2 as engineering graduates will be able to analyze a problem to make a decision about which data structure, algorithm, searching or sorting techniques are appropriate to solve engineering problems and evaluate their solutions.

PO3: CSC 303.4 and CSC 303.5 maps to PO3 since students will be able to develop solution to real world problems with the help of data structure and searching/sorting algorithm.

PSO1: CSC303.1, CSC303.2, CSC303.3, CSC 303.4, CSC 303.5 and CSC303.6 maps to PSO1 as Engineering graduates will be able to have strong foundation and ability to use cutting– edge AI tools and techniques to innovate and develop new solutions.

CO Assessment tools:

1) CSC305.1 Implement various linear and nonlinear data structures. Target: 2.5

Direct Method	**Weightage**	**Target**	**Marks**
Unit Test 1	0.2	60% of students will minimum score 80% marks	20 M
University Exam (Theory)	0.2(TH)	60% of students will minimum score 60% marks	80M
University Exam (Practical)	0.25(PR)	60% of students will minimum score 80% marks	25M
Assignment 1	0.1	75% of students will minimum score 75% marks	10M
Lab Performance	0.2	75% of students will minimum score 70% marks	100M
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

CSC305.1 dm = 0.2UT1 +0.1Q1+ 0.2UniexamTH+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 operations like searching, insertion, deletion and traversals on various data structures.**
Target: 2.5

Direct Method	Weightage	Target	Marks
Unit Test 1	0.2	60% of students will minimum score 80% marks	16 M
University Exam (Theory)	0.25(TH)	60% of students will minimum score 80% marks	80M
University Exam (Practical)	0.25(PR)	60% of students will minimum score 60% marks	25M
Lab Performance	0.2	75% of students will minimum score 70% marks	20M
Assignment 1	0.1	75% of students will minimum score 75% marks	10M

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

CSC303.2:

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

CSC305.2 dm = 0.2UT1 + 0.25UniexamTH+0.25UniexamPR+ 0.1Assignment +0.2Lab

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

CSC305.1*idm*

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

3) CSC303.3. Able to explain various data structures, related terminologies and its types.
Target: 2.7

Direct Method	**Weightage**	**Target**	**Marks**
Unit Test 2	0.1	60% of students will minimum score 80% marks	04 M
Assignment 2	0.3	60% of students will minimum score 80% marks	20M
University Exam (Theory)	0.25(TH)	60% of students will minimum score 60% marks	80M
University Exam (Practical)	0.25(PR)	60% of students will minimum score 70% marks	25M
Lab Performance	0.2	75% of students will minimum score 70% marks	20M
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+ Uni Exam+ Case study+ Lab performance

CSC305.3dm = 0.1UT2 + 0.25UniexamTH+ 0.25UniexamPr +0.2Lab

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

CSC305.3*idm*

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

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

Target: 2.8

Direct Method	**Weightage**	**Target**	**Marks**
Unit Test 1	0.2	60% of students will minimum score 80% marks	20 M
University Exam (Theory)	0.2(TH)	60% of students will minimum score 60% marks	80M
University Exam (Practical)	0.25(PR)	60% of students will minimum score 80% marks	25M
Assignment 2	0.1	75% of students will minimum score 75% marks	10M
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.4:

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

CSC305.4dm = 0.2UT1 + 0.25UniexamTH+0.25UniexamPR+ 0.1Assignment

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

CSC305.4*idm*

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

CSC303.5 Able to analyze and Implement appropriate searching techniques for a givenproblem

Target: 2.8

Direct Method	Weightage	Target	Marks
Unit Test 2	0.1	60% of students will minimum score 80% marks	04 M
Assignment 2	0.3	60% of students will minimum score 80% marks	20M
University Exam (Theory)	0.2(TH)	60% of students will minimum score 60% marks	80M
University Exam (Practical)	0.2(PR)	60% of students will minimum score 70% marks	25M
Lab Performance	0.2	75% of students will minimum score 70% marks	20M
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	85% of students strongly agree and agree	

CSC303.5:

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

CSC305.5dm = 0.2UT1 + 0.25UniexamTH+0.25UniexamPR+ 0.1Assignment + 0.2LabPerf

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

CSC305.5*idm*

CSC305.5 = 0.8* CSC305.5dm + 0.2* CSC305.5idm

CSC303.6 Able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions. Target: 2.8

Direct Method	Weightage	Target	Marks
Demonstration of Mini	0.75	75% of students will minimum score 70%	20M

Project		marks	
Report	0.25	75% of students will minimum score 70% marks	
Indirect Method	**Weightage**	**Target**	
Course Exit Survey	1	75% of students strongly agree and agree	

CSC303.6:

a. **Direct Methods (80%):** Mini Project + Report

CSC305.6dm = 0.75MiniProject+0.25Report

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

CSC305.6*idm*

CSC305.6 = 0.8* CSC305.6dm + 0.2* CSC305.6idm

Course Outcomes Target:

CSC303.1	Able to implement Linear and Non-Linear data structures. **Target level: 2.5**
CSC 303.2	Able to handle various operations like searching, insertion, deletion and traversals on various data structures. **Target level: 2.5**
CSC 303.3	Able to explain various data structures, related terminologies and its types. **Target level: 2.7**
CSC 303.4	Able to choose appropriate data structure and apply it to solve problems in various domains. **Target level: 2.8**
CSC 303.5	Able to analyze and Implement appropriate searching techniques for a givenproblem. **Target level: 2.8**
CSC 303.6	Able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions. **Target level: 2.8**

CO Attainment of previous years

Course Outcomes	2021-22
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
CSC 305.5: Able to analyze and Implement appropriate searching techniques for a givenproblem.	2.28
CSC 303.6: Able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.	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: 2021-22**

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

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	01/7/2022	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 I	Infix to Postfix conversion and examples on it.	Classroom teaching
8	08/08/2022	05/08/2022 I	Implementation of Infix to Postfix	PPT presentation in classroom
9	11/08/2022	8/8/2022	Algorithm and implementation of Evaluation of postfix expression with examples.	PPT presentation in classroom
10	18/08/2022	8/8/2022	Queue-Introduction, Representation using array and implementation of queue using array.	Classroom teaching, Self learning online resources
11	22/08/2022	11/8/2022	Circular queue, implementation and applications of circular queue	Demonstration of program using CodeBlocks in classroom
12	23/08/2022	18/8/2022	Double ended queue: Introduction, applications, Algorithm of insert and remove in Doble ended queue.	PPT presentation in classroom
13	25/08/2022	22/08/2022	Implementation of Deque, Priority queue, applications of it.	Classroom teaching
14	29/08/2022	22/08/2022	Implementation of Deque, Priority queue, applications of it…..continued	PPT presentation in classroom
15	30/08/2022	23/08/2022	Intoduction to Linked List, Difference between static and dynamic memory allocation.	PPT presentation in classroom
16	06/09/2022	23/08/2022	Types of linked list, Singly, Circular and Doubly Linke List.	Classroom teaching, Self learning online resources

17	08/09/2022	25/08/2022	Linked List: Introduction, Create_node() function of linked list	Demonstration of program using CodeBlocks in classroom
18	12/09/2022	25/08/2022	Insert_end and insert_begin in linked list	PPT presentation in classroom
19	13/09/2022	29/08/2022	insert_begin, insert_pos, remove_first node functions in linked lkist	Classroom teaching
20	15/09/2022	30/08/2022	Remove a.last node, b. node at specific position, c. split, d.concatenate etc opertaions on linked list	PPT presentation in classroom
21	19/09/2022	08/09/2022	Revision of all previous operations	PPT presentation in classroom
22	20/09/2022	12/09/2022	Concatenate, create_linked_list, copy and reverse function on linked list	Classroom teaching, Self learning online resources
23	22/09/2022	13/09/2022	Operations on circular linked list	Demonstration of program using CodeBlocks in classroom
24	26/09/2022	15/09/2022	Doubly Linked list and implementation of all operations on it.	PPT presentation in classroom
25	27/09/2022	20/09/2022	Applications of linked list, introduction to Tree data structure, basic terminologies in tree data structure.	Classroom teaching
26	29/09/2022	22/09/2022	Binary tee representations, tree traversal techniques	PPT presentation in classroom
27	03/10/2022	26/09/2022	construction of binary tree from given traversal sequences, Definition of Binary search Tree,	PPT presentation in classroom

			algorithm for insert and search operation, Construction of BST.	
28	04/10/2022	27/09/2022	Insert, Search operation in BST	Classroom teaching, Self learning online resources
29	06/10/2022	29/09/2022	Delete operation with all four cases, count leaf nodes, count non leaf nodes in BST,	Demonstration of program using CodeBlocks in classroom
30	10/10/2022	03/10/2022	AVL Search Tree, Rotations like Rotate left and rotate right, practice problems on AVL	PPT presentation in classroom
31	11/10/2022	04/10/2022	Huffman Encoding, B-Tree and B+ Tree, Graph: Introduction, Basic terminologies, Graph representations	Classroom teaching
32	13/10/2022	6/10/2022	Graph traversal algorithms with examples, DFS and BFS, Topological sort, applications of graph, practice questions on topological sort, DFS and BFS	PPT presentation in classroom
33	17/10/2022	10/10/2022	Binary search and hashing: introduction, collision resolution techniques: separate chaining	PPT presentation in classroom
34	18/10/2022	11/10/2022	Topological sort, applications of graph, practice questions on topological sort, DFS and BFS	Classroom teaching, Self learning online resources
35	20/10/2022	13/10/2022	Binary search and hashing: introduction, collision resolution techniques: separate chaining	Demonstration of program using CodeBlocks in classroom
36	24/10/2022	14/10/2022	Collision Resolution Technique, Open Addressing: Linear Probing	PPT presentation in classroom
37	25/10/2022	14/10/2022	Quadratic Probing, Double hashing	Classroom teaching
38	27/10/2022	14/10/2022	B Tree and B+ Tree Revision	PPT presentation in classroom

39	27/10/2022	14/10/2022	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	14/10/2022	Revision and Doubt solving session	Online class in the evening
Remedial classes				
41	01/11/2022	24/11/2022	Revision, doubt solving and discussion on topics given by students.	Classroom teaching using black board
42	03/11/2022	25/11/2022	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)**

Sr. No	Aim	CO Mapping	Weekly Plan
1.	1.1 Static implementation of Stack data structure 1.2 Two Stacks in an Array	CSC303.1	Third Week
2.	Application of Stack data structure: 2.1 Postfix expression Evaluation. 2.2 Infix to Reverse Polish Notation (Infix to Postfix) 2.3 Infix to Polish Notation (Infix to Prefix)	CSC303.1	Fourth Week
3.	3.1 Static Implementation of Linear Queue data structure 3. 2 Static Implementation of Circular Queue	CSC303.1	Fifth Week
4.	Linked List Implementation	CSC303.1	Sixth Week
5.	5.1 Sparse Matrix Implementation using LL 5.2 Polynomial Operations using LL	CSC303.1	Eighth Week
6.	6.1 Dynamic implementation of Stack 6.2 Dynamic implementation of Queue	CSC303.1	NinethWeek
7.	Implementation of Circular Linked List	CSC303.1	TenthWeek
8.	Implementation of Doubly Linked List	CSC303.1	Tenth Week

9.	Implementation of Priority Queue	CSC303.1	Tenth Week
10	Static implementation of Dequeue	CSC303.1	TenthWeek
11	11.1 Implementation of BST(insertion, deletion, traversal) 11.2 Expression Tree	CSC303.2	Eleventh Week
12	Graph Creation. BFS AND DFS Traversal	CSC303.2	Eleventh Week
13	Searching Techniques 13.1 Linear Search 13.2 Binary Search	CSC303.2	Twelth Week
14	Assignment 1	CSC303.2 CSC303.2 CSC303.2	Sixth week
15	Assignment 2	CSC303.2 CSC303.2 CSC303.2	Sixth 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:

- Advanced Lists
- n-ary Tree
- Self-Balancing BSTs
- Trie

Assignment 1

Sub: Data Structures

Class: SE
AI&DS

Assignment Date: 24 th September 2022

Date of submission: 30th October 2022

Course outcome:

CSC305.1: CO1: Implement various linear and non-linear data structures

CSC305.4: CO4: Choose appropriate data structure and apply it to solve problems in various domains

Q. No.	Question No.	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 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
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

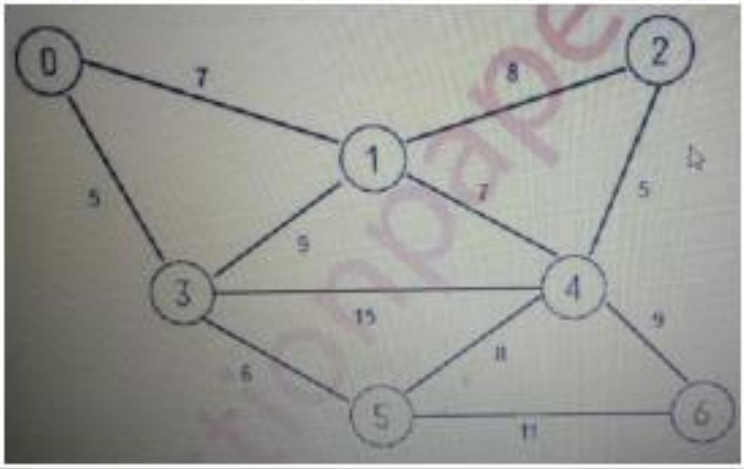
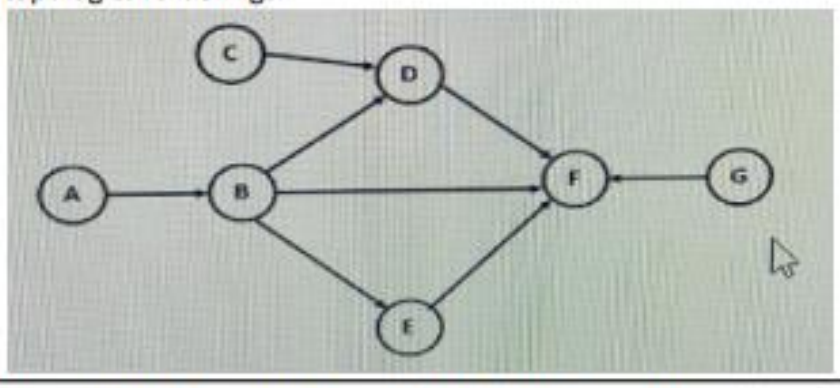
6	Write a C program to implement Insert_Front and Delete_Rear on Double Ended Queue using array.	CSC303.1	3	1.4.1
7	Explain following data structures, related terminologies and its types. (Draw diagram, Write definition and applications) Circular queue Double ended queue Priority queue Doubly linked 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?	CSC303.4	5	2.1.3

	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. AI&DS (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

Fr. C.R.C.E. Bandra
Unit Test-I
DATA STRUCTURE (CSC303)

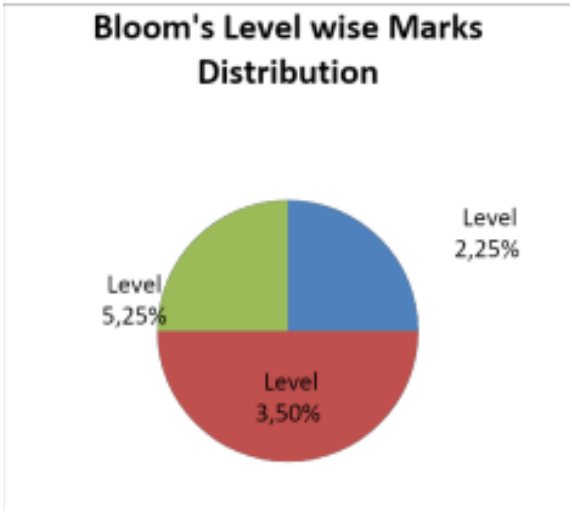
Class: S.E. (AI&DS) **Time:** 1.00pm- 2.00pm
Date: 6/09/2022 **Total Marks:** 20

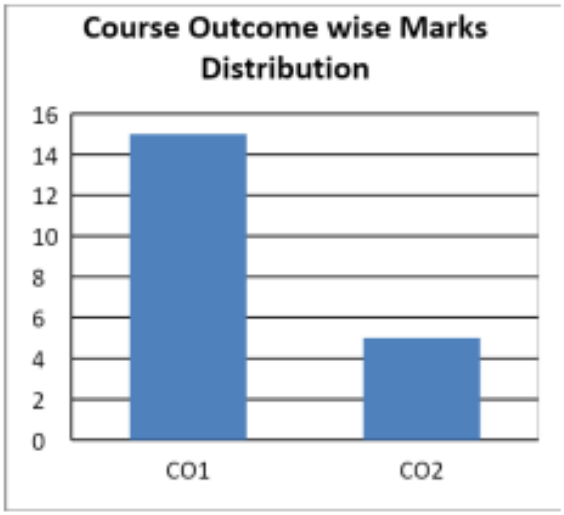
CSC303.1*: Implement various linear and non-linear Data Structures*
CSC303.*4:* Choose appropriate data structure and apply it to solve problems in various domains

Note: All assumptions need to state clearly.

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

Fr. C.R.C.E. Bandra

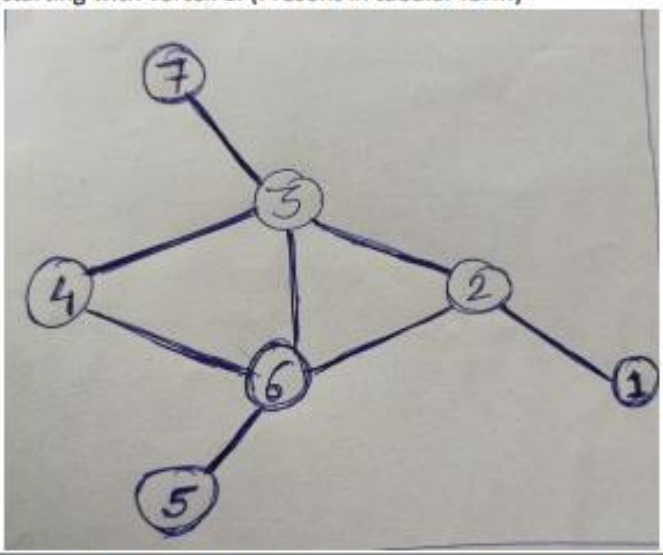
Unit Test-II

Class: S.E. (AI&DS) Subject: Data Structure

Date 18/10/22 Time: 1.00Pm – 2.00Pm

CSC303.2: Implement various linear and Nonlinear data structures

CSC303.3: Implement appropriate searching technique 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

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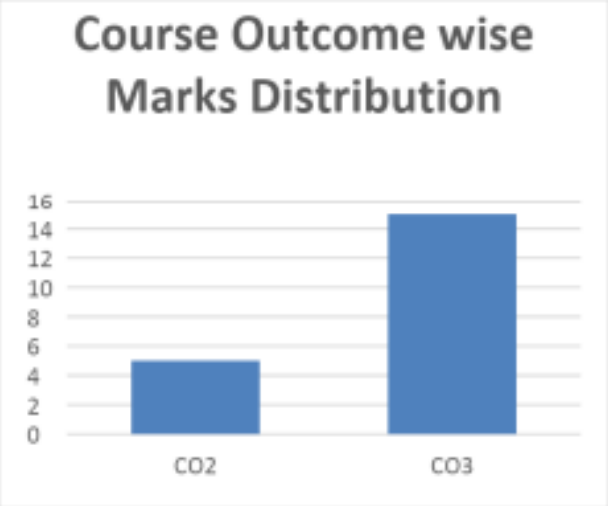

Action Taken for weak students:

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

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