

JAIN (DEEMED-TO-BE UNIVERSITY)
BENGALURU, KARNATAKA

PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS

Teaching - Learning & Evaluation Plan

Course Information:

Course Code:	23BCA2C04	Course Title:	DATA STRUCTURES
Credits Units: 3	Total Contact Hours: 45	L-T-P: 3-0-0	
CA: ESE Weightage- 50:50	Pass Marks (IA and UE): 0 and 18	Aggregate Pass Marks: 40%	
UE Question Paper Marks: 50	Special Examination Fees: NA	Pre-requisite (if any): NA	

Course Facilitator (s):

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Dr. Clara Shanthi D, Associate Professor, School of CS & IT.
Dr. Deepak Mehta, Associate Professor, School of CS & IT.
Ms. Sonali Karale, Assistant Professor, School of CS & IT.
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Mr. Saravanan, Assistant Professor, School of CS & IT.
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Dr. Shyam R, Assistant Professor, School of CS & IT.

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

Programme Outcomes (POs)	
At the end of the programme, students will be able to	
PO 1	Computational Knowledge: Understand and apply mathematical foundation, computing, and domain knowledge for the conceptualization of computing models from defined problems.
PO 2	Problem Analysis: Ability to identify, critically analyze and formulate complex computing problems using fundamentals of computer science and application domains.
PO 3	Design / Development of Solutions: Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand, and propose integrated solutions using emerging technologies.
PO 4	Conduct Investigations of Complex Computing Problems: Ability to devise and conduct experiments, interpret data and provide well informed conclusions.
PO 5	Modern Tool Usage: Ability to select modern computing tools, skills and techniques necessary for innovative software solutions.

PO 6	Professional Ethics: Ability to apply and commit professional ethics and cyber regulations in a global economic environment.
PO 7	Life-long Learning: Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
PO 8	Project Management: Ability to understand management and computing principles with computing knowledge to manage projects in multidisciplinary environments.
PO 9	Communication Efficacy: Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.
PO 10	Societal & Environmental Concern: Ability to recognize economic, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.
PO1 1	Individual & Teamwork: Ability to work as a member or leader in diverse teams in multidisciplinary environment.
PO1 2	Innovation and Entrepreneurship: Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
Program Specific Outcomes (PSO's)	
PSO 1	Pertain current knowledge and adapting to emerging applications of Mathematics, Science fundamentals in the field of Computer science and its applications.
PSO 2	Exhibit proficiency in identifying, formulating and analysing complex problems in the computer environment.
PSO 3	Ability to create, select and apply appropriate modern techniques for solving complex issues.
PSO 4	Explore technical knowledge in diverse areas of Computer Applications and experience a conducive environment in nurturing skills for successful career and higher studies.

Course Objectives:

COURSE OBJECTIVES	
COB1	Students will get understanding of different data structures used in data processing
COB2	Students will analyze the operations on different data structures
COB3	Students will recognize the suitability of data structures in data manipulation
COB4	Students will apply suitable data structures in building real-world applications

Course Outcomes:

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

Sl. No.	Course Outcome	Description	Bloom's Taxonomy Level
1.	CO 1	Understand the basics of data structures and its classification.	Understanding (2)
2.	CO 2	Implement the searching and sorting techniques in real life applications.	Applying (3)
3.	CO 3	Implement concepts on stack and queue operation and its implementation	Applying (3)
4.	CO 4	Interpret the knowledge of linked list on node of array.	Applying (3)
5.	CO 5	Implement the concepts of trees and its applications.	Applying (3)

CO-PO/PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	-	-	-	-	-	-	-	-	2	1	2	2
CO2	3	3	3	-	-	-	-	-	-	-	2	2	3	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	2	2	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	2	2	3	3	3	3
CO5	3	3	3	-	-	-	-	-	-	-	2	2	3	3	3	3
Total	14	14	14								8	8	14	13	13	13
Average	2.8	2.8	2.8	0	0	0	0	0	0	0	2	2	2.8	2.6	2.6	2.6

Course Contents:

Module	Details	Contact Hours
1	Introduction to Data structures: Definition, Classification of data structures: primitive and non-primitive, Elementary data organization, Operations of linear data structure Time and space complexity of an algorithm (Examples), String processing, Arrays – Insert and deletion of elements (before, after and in-between), Fundamentals of ADT's.	09

	Introduction to Dynamic Memory allocation (malloc(), calloc(), etc). Basics of Recursion.	
2	Searching and Sorting: Basic Search Techniques: Introduction to Searching, Linear search, Binary search; Comparison of Binary and linear search. Sorting: Introduction to sorting, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort.	09
3	Stack & Queue: Stack: Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue; Types of queues: Simple queue, Circular queue, Double ended queue (deque), Priority queue, Operations on all types of Queues.	09
4	Linked List: Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list; Types of linked list: Singly linked list, doubly linked list, Circular linked list; Operations on SLL, DLL and CLL: creation, insertion, deletion, search and display.	09
5	Trees and Graphs: Definition: Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree, AVL Tree, Terminology: Root, Node, Degree of a node and tree, Terminal nodes, non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node; Array representation of tree, Creation of binary tree and BST; Traversal of Binary Tree: Preorder, Inorder and postorder. Implementation of Graphs, DFS and BFS.	09

Text Books (TB):

TB1	Fundamentals of Data Structures in C, Ellis Horowitz and Sartaj Sahni, 2nd Edition, Universities Press, 2014
TB2	Data Structures, Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014
TB3	Data Structures and program designing using 'C' by Robert Kruse, II Edition, Pearson Education
TB4	Data Structures and Algorithm Analysis in C by Weiss, II Edition, Pearson Education, 2001
TB5	An Introduction to Data Structures with Application Paperback by Jean-Paul Tremblay (Author), Paul Sorenson (Author)

Reference Books (RB):

RB-1	Data Structures in C by D. Srivastava, II Edition, BPB Publishers, 2004
RB-2	Data Structures , 2/e, Richard F, Gilberg, Forouzan cengage

Web Video Links (WVL):

WVL-1	https://swayam.gov.in/explorer?searchText=data+structures
WVL-2	https://youtu.be/eGnlKPCkAFY
WVL-3	https://youtu.be/f_9-LEQR6-I
WVL-3	https://onlinecourses.nptel.ac.in/noc24_cs45/preview

Web Text Links (WTL):

WTL-1	https://www.javatpoint.com/data-structure-tutorial
WTL-2	https://www.tutorialspoint.com/data_structures_algorithms/index.htm
WTL-3	e-book https://ebooks.lpude.in/computer_application/mca/term_2/DCAP407_DATA_STRUCTURE.pdf

MOOC Courses (MC):

Sr.No.	Platform	Topic	CO	Link	Duration
MC-1	LinkedIn Learning	Programming Foundations: Data Structures	CO1	https://www.linkedin.com/learning/programming-foundations-data-structures-2/understand-data-structures?u=92695330	2 Hrs 20 Mins
MC-2	LinkedIn Learning	C: Data Structures, Pointers, and File Systems	CO1 CO2	https://www.linkedin.com/learning/c-data-structures-pointers-and-file-systems/learn-data-structures-and-pointers-in-c?u=92695330	2 hour 54 min
MC-3	LinkedIn Learning	Python Data	CO3	https://www.linkedin.com/learning/python-data-structures-stacks-queues-and-deques/what-you-	1 hour 24 mins

		Structures: Stacks, Queues, and Dequeues		should-know?autoSkip=true&autoplay=true&resume=false&u=92695330	
MC-4	LinkedIn Learning	Python Data Structures: Linked Lists	CO4	https://www.linkedin.com/learning/python-data-structures-linked-lists/understanding-linked-list-data-structures-in-python?u=92695330	1 hours 29 mins
MC-5	LinkedIn Learning	Python Data Structures: Trees	CO4 CO5	https://www.linkedin.com/learning/python-data-structures-trees/getting-started-with-trees?u=92695330	1 hours 16 mins
Total MOOC Course integration with Certification					9 hours 30 Mins

Session-Wise Plan:

Module	Session	Topic	Readings and References	Pedagogy/ Activity Planned	CO	Mode of Delivery
01	1-3	Introduction to Data structures: Definition, Classification of data structures: primitive and non-primitive, Elementary data organization, Operations of linear data structure.	TB1, TB5	Determines the new data structure concept and Analyses the performance of different algorithms.	1	Online Synchronous PPT and Discussion
	4-7	Time and space complexity of an algorithm (Examples), String processing, Arrays – Insert and deletion of elements (before, after and in-between), Fundamentals of ADT's.	TB1, TB5	Understanding the time and space complexity of an algorithm. Activity:	1	flipped classroom, PPT and discussion

	8-9	Introduction to Dynamic Memory allocation (malloc(), calloc(), etc). Basics of Recursion.	TB3	Explanations with examples Activity (Project: programs on Fibonacci, GCD. Using recursion)	1	flipped classroom, Direct Instruction
02	10-13	Basic Search Techniques: Introduction to Searching, Linear search, Binary search; Comparison of Binary and linear search.	TB 5	PROGRAMS on searching techniques.	2	Asynchronous Practical/ Workshop Learning
	14-18	Sorting: Introduction to sorting, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort.	TB 5	Understanding types with examples PROGRAMS on sorting to calculate the complexity and memory allocation	2	Practical/ Workshop Learning
03	19-23	Stack & Queue: Stack: Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks.	Stack TB1, TB5 Queue TB1, TB5	Implementation of all operations of stack.	3	Online Synchronous PPT and Discussion Practical/ Workshop Learning
	24	Queue: Definition, Array representation of queue; Types of queues: Simple queue, Circular queue, Double ended queue (deque), Priority queue.	Queue and types TB1, TB5	Implementation of all operations of queue.	3	Online Synchronous PPT, video, Practical/ Workshop Learning
	25-27	Operations on all types of Queues	TB1, TB5	Explanations with examples	3	Online Synchronous PPT and Discussion
04	28-29		TB1, TB3	Understanding the	4	Online

		Linked List: Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list;		different types of linked list		Synchronous PPT, video, Practical/ Workshop Learning
	30-31	Types of linked list: Singly linked list, doubly linked list, Circular linked list	TB1,TB3	Explanations with examples.	4	Practical/ Workshop Learning flipped classroom,
	32-36	Operations on singly, doubly and circularly linked list: creation, insertion, deletion, search and display	TB1,TB3	Implementation of all operations of linked list.	4	Online Synchronous PPT, videos and discussion
05	37-39	Trees: Definition: Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree;	TB4 TB5	Determine the concepts of trees	5	Online Synchronous PPT, video flipped classroom
	40-43	Terminology: Root, Node, Degree of a node and tree, Terminal nodes, non- terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node; Binary tree: Array representation of tree, Creation of binary tree; Traversal of Binary Tree: Preorder, Inorder and postorder.		Exercises on how to work with the traversal	5	SELF STUDY Discussion/ interaction Synchronous
	44-45	Implementation of Graphs, DFS and BFS.	TB4 TB5	Explanation with examples.	5	Online Synchronous PPT and

						discussion
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Assessment Scheme: CA: UE – 50:50

Sl. No.	Assessment Instrument	Formative/ Summative	Frequency/Stages	Weightage (%)	CO
1.	Skill Enhancement Activity-1 - Online Certificate Courses	Formative	1	15	CO1, CO2
2.	Content Improvement Activity-2 -Mini Project on OS Concepts using C/DS Concepts		1	15	CO2,CO3, CO4, CO5
3.	Class Participation	Continuous	-	5	-
4.	Periodic Test	Formative	1	5	CO1, CO2
5.	Preparatory Exam	Formative	1	10	CO1, CO2, CO3, CO4, CO5
5.	End Semester Examination	Summative	1	50	CO1, CO2, CO3, CO4, CO5
Total				100	

Assessment Sheet with Rubrics for Grading & Evaluation

Activity-1 Online Certificate Course and Report:

Sr. No.	USN No.	Student Name	On-time Submission	Learning Outcomes	Report with course details and assessment	Viva-Voce	Total	Conversion
			10 Marks	15 Marks	15 Marks	10 Marks	50 Marks	15 Marks

Activity-2 Mini Project on DS Concepts using C and OS Concepts:

[illegible]