PART A: Introduction				
Program: **Certificate**		Class: **B.C.A.**	Year: **I Year**	Session: **2025-26**
Subject: **Computer Applications**				
1.	Course Code			
2.	Course Title	**Data Structures (Theory)**		
3.	Course Type (Core Course/DSE/Minor/ MD-ID/ SEC/VOC)	**Major – III** (Core Course)		
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.		
5.	Course Learning Outcomes (CLO)	**After the completion of this course, a successful student will be able to do the following**: 1. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles. 2. Have knowledge of complexity of basic operations like insert, delete, search on these data structures. 3. Possess ability to choose a data structure to suitably model any data used in computer applications. 4. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 5. Assess efficiency tradeoffs among different data structure implementations. 6. Implement and know the applications of algorithms for searching and sorting. 7. Know the contributions of Indians in the field of programming and data structures.		
6.	Credit Value	**Theory – 4 Credits**		
7.	Total Marks	Max. Marks : **30 + 70**	Min. Passing Marks: **35**	

PART B: Content of the Course		
No. of Lectures (in hours per week): **2 Hrs. per week**		
Total No. of Lectures: **60 Hrs.**		
Module	**Topics**	**No. of Lectures**
I	**Indian Knowledge System:** Resemblance of efficient Sorting & Searching techniques with Ancient Indian classification methods in Ayurveda & Sanskrit texts. The Buddhist Numerical Sorting Method (Bhāskara II). Indian	02

Prof. (Dr.) Umesh Kumar Singh
Dean, Faculty of Engineering Sciences,
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	contribution in Data Structure: Dr. Sartaj Sahni, Dr. Arvind, R. K. Gupta.	
	Suggested Activities: *Vedic Sorting Implementation: Develop a sorting algorithm inspired by Ayurvedic classification techniques. Study the resemblance of temple architecture to graph connectivity and model it using Graphviz/Network..*	
II	**Data Structure:** Basic concepts, Linear and Non-Linear data structures **Algorithm Specification:** Introduction, Recursive algorithms, Data Abstraction, Performance analysis. **Arrays:** Representation of single, two-dimensional arrays, triangular arrays, sparse matrices-array and linked representations.	10
	Suggested Activities: *Implementing a Simple To-Do List using Linear Data Structures, Exploring Non-Linear Data Structures with a Family Tree, Sparse Matrix Operations Using Arrays.*	
III	**Stacks:** Operations, Array and Linked Implementations, Applications- Infix to Postfix Conversion, Infix to Prefix Conversion, Postfix Expression Evaluation, Recursion Implementation. **Queues:** Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation. **Linked Lists:** Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists-Operations, Doubly Circular Linked List, Header Linked List.	14
	Suggested Activities: *Express Calculator Using Stacks, Queue Simulation for a Bank System, Linked List-Based Music Playlist, Compare linked list pointer-based structure with ancient manuscript referencing, Develop a queue system (FIFO) for handling real-world ticket processing.*	
IV	**Trees:** Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees. **Heap:** Definition, Insertion, Deletion.	12
	Suggested Activities: *Create efficient storage models for Ayurveda medicinal records using tree-based structures. Research how Vedic knowledge management compares with modern database indexing, Implement tree traversal to simulate genealogy in Vedic lineage texts, Implement heap sorting for priority based Ayurveda classification.*	
V	**Graphs:** Graph ADT, Graph Representations, Graph Traversals, Searching. **Hashing:** Introduction, Hash tables, Hash functions, Overflow Handling.	10

Prof. (Dr.) Umesh Kumar Singh
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	Suggested Activities: *Model Indian temple network connectivity using graph algorithms, Social Network Graph Simulation, Implementing a Hash Map, Graph-Based Maze Solver.*	
VI	**Sorting:** Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison of Sorting Methods, **Search Trees:** Binary Search Trees, AVL Trees- Definition and Examples.	12
	Suggested Activities: *Students compete to optimize sorting algorithms based on Ayurvedic classification techniques, Use binary trees to model ancient Indian lineage systems.*	

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings:
Textbooks: 1. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005. 2. Udayan S. Patankar & Sunil M. Patankar: Elements of Vedic Mathematics, TTU Press, Tallinn 2018. 3. Sartaj Sahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill. 4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson. 5. D. S. Malik, "Data Structure using C++", Second edition, Cengage Learning. 6. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें। **Reference Books:** 1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning. 2. M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson. 3. Lipschutz, "Schaum's outline series Data structures", Tata McGraw-Hill.
Suggestive Digital Platform Web Links:
https://www.eshiksha.mp.gov.in/mpdhe https://epgp.inflibnet.ac.in
Suggested Equivalent Online Courses:
https://nptel.ac.in/courses/106/102/106102064/ https://nptel.ac.in/courses/106/106/106106127/ https://nptel.ac.in/courses/106/105/106105085/

Prof. (Dr.) Umesh Kumar Singh
Dean, Faculty of Engineering Sciences,
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<table>
<tr><th colspan="3">Part D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 30 Marks
University Exam (UE): 70 Marks</td></tr>
<tr><td colspan="2">Internal Assessment:
Continuous Comprehensive Evaluation (CCE)</td><td>Total Marks: 30</td></tr>
<tr><td>External Assessment:
University Exam Section
Time: 03.00 Hours</td><td>Section (A) : Very Short Questions
Section (B) : Short Questions
Section (C) : Long Questions</td><td>Total Marks: 70</td></tr>
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Prof. (Dr.) Umesh Kumar Singh
Dean, Faculty of Engineering Sciences,
Vikram University, Ujjain (MP)

PART A: Introduction				
Program: **Certificate**		Class: **B.C.A.**	Year: **I Year**	Session: **2025-26**
Subject: **Computer Applications**				
1.	Course Code			
2.	Course Title	**Data Structures (Practical)**		
3.	Course Type (Core Course/DSE/Minor/MD-ID/ SEC/VOC)	**Major – III** (Core Course)		
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.		
5.	Course Learning Outcomes (CLO)	**After the completion of this course, a successful student will be able to do the following**: 1. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles. 2. Have knowledge of complexity of basic operations like insert, delete, search on these data structures. 3. Possess ability to choose a data structure to suitably model any data used in computer applications. 4. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 5. Assess efficiency tradeoffs among different data structure implementations. 6. Implement and know the applications of algorithms for searching and sorting. 7. Know the contributions of Indians in the field of programming and data structures.		
6.	Credit Value	**Practical – 2 Credits**		
7.	Total Marks	Max. Marks: **100**	Min. Passing Marks: **35**	

PART B: Content of the Course		
No. of Lab Practical's (in hours per week): **1 hours per week**		
Total No. of Lab.: **30 Hrs.**		
	Suggestive list of Practical's	**No. of Labs.**
	Given the problem statement, students are required to formulate problem,	30 Hrs.

Prof. (Dr.) Umesh Kumar Singh
Dean, Faculty of Engineering Sciences,
Vikram University, Ujjain (MP)

	develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. Write a program to find largest element from an array. 2. Write a program to implement push and pop operations on a stack using array. 3. Write a program to perform insert and delete operations on a queue using array. 4. Write a program for Linear search. 5. Write a program for Binary search. 6. Write a program for Bubble sort. 7. Write a program for Selection sort. 8. Write a program for Quick sort. 9. Write a program for Insertion sort. 10. Write a program to implement linked list.	

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Prof. (Dr.) Umesh Kumar Singh
Dean, Faculty of Engineering Sciences,
Vikram University, Ujjain (MP)

PART D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/Quiz		Viva voce practical	
Attendance		Practical record file	
Assignments (Charts/ Model/Seminar/Rural Services/ Technology Dissemination/Report of Excursion/Lab visit/ Survey/Industrial Visit)		Table work/Experiment	
Total	**30**		**70**

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