Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Computer Science Department

Part A - Introduction			
Programme – B.C.A. (Computer Applications - Major)	**Class** – B.C.A. II Semester	**Year- 2025**	**Session- 2024-25**

Course Type (Computer Applications) – Major

1	**Course Code**	S2-BCA1T
2	**Course Title**	Programming Methodology & Data Structures
3	**Pre – requisite (if any)**	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.
4	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top-down design principles. 2. Writing efficient and well- structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques. pointers and searching methods in Programming. 5. Will be familiar with fundamental data structures, their implementation: become accustomed to the description of algorithms in both functional and procedural styles. 6. Have knowledge of complexity of basic operations like insert. delete, and search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables. 9. Assess efficiency trade-offs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contributions of Indians in the field of programming and data structures.
5	**Credit Value**	4 Credits
6	**Total Marks**	Formative Assessment (CCE) – 40 Marks Summative Assessment (End Semester Exam) – 60 Marks **Total 40+60= 100 Marks** **Minimum Pass Marks – 35**

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Govt. Holkar Science College
INDORE (M.P.)

27/02/25

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Course Title	Programming Methodology & Data Structures		

Part – B Content of the Course		
Total no. of lectures – As per UGC rules (1 Credit = 15 Lectures)		
S. No.	**Topics**	**No. of Lectures**
I	Introduction to Programming - Program Concept, Characteristics of Programming. Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies. Basics of C++: A Brief History of C++, Application of C++, Compiling & Linking, Tokens, Keywords, Identifiers & Constants. Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators. Type Cast Operator. Functions In C++: The Main Function, Function Prototyping, Call by Reference, Call by Address, Call by Value, Return by Reference, Inline Function, Default Arguments, Constant Arguments, Function Overloading, Function with Array.	12
II	Classes & Objects: A Sample C++ Program with Member Functions, Making an Outside Function Inline, Nesting of class, Defining Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member, Functions. Array of Objects, Object as Function Arguments, Friend Functions, Virtual functions, Returning Objects, Constant member functions, Pointer to Members, Local Classes. Constructor & Destructor: Default Constructor, Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor. Inheritance: Defining Derived Classes, Single Inheritance. Making a Private Member Inheritable, Multilevel Inheritance. Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes. Operator Overloading & Type Conversion, Polymorphism, Pointers, Pointers with Arrays, C++ Streams, C++ Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output with Manipulators, Exception Handling.	14

HEAD
Department of Computer Science
Govt. Holkar Science College
INDORE (M.P.)
27/02/25

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III	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. 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.	12
IV	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 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. Graphs: Graph ADT, Graph Representations, Graph Traversals, Searching.	12
V	Hashing: Introduction, Hash tables, Hash functions, Overflow: Handling. 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. Indian Contribution to the field: Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new. Programming Languages, open source languages, Dr. Sartaj Sahni computer scientist pioneer of data structures, Other relevant - contributors and contributions.	10

Dr. Pradeep Sharma
HEAD
Department of Computer Science
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INDORE (M.P.)

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Course Type (Computer Applications) – Major			
Course Code	S2-BCA1T		
Course Title	Programming Methodology & Data Structures		

Part – C Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015 E Balguruswamy,
2. "C++", TMH Publication ISBN O-07-462038-X
3. Herbert Shildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
4. मध्यप्रदेश हिंदी ग्रंथअकादमी से प्रकाशित विषय से संबंधित पुस्तकें.

Reference Books:

1. R. Lafore, 'Object Oriented Programming C++"
2. N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning
3. Adam Droozdek, "Data Structures and algorithm in C++, Third Edition, Cengage Learning.
4. SartajSahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
5. Robert L. Kruse, "Data Structures and Program Design in C++, Pearson.
6. D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
7. M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
8. Lipschutz. "Schaum's outline series Data structures". "Tata McGraw-Hill

Suggested Digital Platforms Web Links:

1. https://www.youtube.com/watch?v=BCIS-40yzsA
2. http://www.youtube.com/watch?v=vl.nPwxZdW4Y&vien
3. https://www.youtube.com/watch?vUmm120S17w

Suggested Equivalent Online Courses:

1. https://nptel.ac.in/courses/106/105/106105151/
2. https://www.udemy.com/course/begining-c-plus-plus-programming/

Dr. Pradeep Sharma
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Department of Computer Science
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INDORE (M.P.)

27/02/25

Part A - Introduction			
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Course Type (Computer Applications) – Major			
Course Code	S2-BCA1T		
Course Title	Programming Methodology & Data Structures		

Part – D Assessment and Evaluation				
Internal Assessment: Continuous Comprehensive Evaluation (CCE)/ Formative Assessment: 40 Marks Formative Assessment shall be based on – Quiz, Seminar, Presentation, Written test, Case Study, Project, Assignment etc. The division of marks is as follows:			**External Evaluation (Summative Assessment):** **End Semester Exam:60 Marks** Time: 03 hours	
Test I	20 Marks	Best two test Marks = (20 + 20)	**Section (A):** 5 Objective Questions (1 mark each)	5 x 1= 5
Test II	20 Marks		**Section (B):** 5 Short Questions out of eight questions (200 words each) (7 Marks each)	5 x 7 = 35
Test III	20 Marks		**Section (C):** Two long questions out of four questions (500 Words each) (10 Marks each)	2 x 10 = 20
Total Internal Assessment (CCE) Marks		**40 Marks**	Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**
Note:	**1.**	**For Major, Minor, Open Elective, Foundation and Vocational Courses, Part D will be as per the scheme of marks given.**		
	2.	**The student should secure 35% marks in Internal Assessment (CCE) and External Evaluation (theory) combined.**		

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Department of Computer Science
Govt. Holkar Science College
INDORE (M.P.)

21/02/25

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Computer Science Department

Part A- Introduction (Practical)			
Programme – B.C.A. (Computer Applications - Major)	**Class** – B.C.A. II Semester	**Year- 2025**	Session- 2024-25
Course Type (Computer Applications) – Major			

1.	Course Code	S2-BCA1TP
2.	Course Title	Programming Methodology & Data Structures Lab
3.	Pre-requisite (if any)	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.
4.	Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop straightforward algorithms and flowcharts to address problems, following the principles of top-down design. 2. Generate computer algorithms and programs that are not only efficient but also well-structured, showcasing an understanding of programming principles. 3. Apply iterative problem-solving techniques and develop algorithms for processing arrays in a variety of problem scenarios. 4. Employ recursive methodologies, pointers, and searching strategies when coding, demonstrating the ability to tackle more complex programming challenges. 5. Demonstrate the capability to choose suitable data structures that accurately model data for diverse computer applications. 6. Implement algorithms for both searching and sorting data, showcasing proficiency in algorithmic problem-solving techniques.
5.	Credit Value	2 Credits
6	**Total Marks**	Formative Assessment (CCE) – 40 Marks Summative Assessment (End Semester Exam) – 60 Marks **Total 40+60= 100 Marks** **Minimum Pass Marks – 35**

Dr. Pradeep Sharma
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Department of Computer Science
Govt Holkar Science College
INDORE (M.P.)

Part B- Content of the Course	
Total no. of lectures – As per UGC rules	
Suggestive List of Practicals	
1.	Write a program to swap the contents of two variables.
2.	Write a program for finding the roots of a Quadratic Equation.
3.	Write a program to find area of a circle, rectangle and square usingswitch case.
4.	Write a program to print table of any number.
5.	Write a program to print Fibonacci series.
6.	Write a program to find factorial of a given number usingrecursion
7.	Write a program to convert decimal (integer) number into equivalent binary number,
8.	Write a program to check given string is palindrome or not.
9.	Write a program to print digits of entered number in reverse order.
10.	Write a program to print sum of two matrices.
11.	Write a program to print multiplication of two matrices.
12.	Write a program to generate even/odd series from 1 to 100.
13.	Write a program whether a given number is prime or not.
14.	Write a program for call by value and call by reference.
15.	Write a program to create a pyramid structure 1 12 123 1234
16.	Write a program to check entered number is Armstrong or not.
17.	Write a program to read N numbers and find their average.
18.	Write a program to find the area and volume of a rectangular box using constructor.
19.	Write a program to design a class time with hours, minutes and seconds as data members. Use a data function to perform the addition of two time objects in hours, minutes and seconds,
20.	Write a program to implement single inheritance.
21.	Write a program to find largest element from an array.
22.	Write a program to implement push and pop operations on a stack using array.
23.	Write a program to perform insert and delete operations on a queue using array.
24.	Write a program for Linear search.
25.	Write a program for Binary search.
26.	Write a program for Bubble sort.
27.	Write a program for Selection sort.
28.	Write a program for Quick sort.
29.	Write a program for Insertion sort.
30.	Write a program to implement linked list.

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7. M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
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2. http://www.youtube.com/watch?v=vl.nPwxZdW4Y&vien
3. https://www.youtube.com/watch?vUmm120S17w

Suggested Equivalent Online Courses:

1. https://nptel.ac.in/courses/106/105/106105151/
2. https://www.udemy.com/course/begining-c-plus-plus-programming/

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Part D- Assessment and Evaluation	
Suggested Continuous Evaluation methods:	
Internal Assessment/Formative Examination(A):	40 Marks
Lab Record	15 Marks
Attendance in the Lab	05 Marks
Assignments (It can be in different modes)	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**(40 + 60 =100 Marks)**

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27/02/25