Part A Introduction			
Program : Certificate	Class : BCA II SEMESTER	Year : 2022	Session : 2022-23

1	**Course Code**	**S1-BCAA2T**
2	**Course Title**	Programming Methodology & Data Structures
3	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	Major – Paper II
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: • Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. • Writing efficient and well-structured computer algorithms/ programs. • Learn to formulate iterative solutions and array processing algorithms for problems. • Use recursive techniques, pointers and searching methods in programming. • Will be familiar with fundamental data structures, their implementation: become accustomed to the description of algorithms in both functional and procedural styles. • Have knowledge of complexity of basic operations like insert, delete, and search on these data structures. • Possess ability to choose a data structure to suitably model any data used in computer applications. • Assess efficiency tradeoffs among different data structure implementations. • Implement and know the applications of algorithms for searching and sorting. • Know the contributions of Indians in the field of programming and data structures.

6	**Credit Value**	**Theory – 4 Credits Practical – 2 Credits**	
7	**Total Marks**	Max. Marks : 100	Min. Marks : 40
Part B – Content of the Course			
No. of Lectures (in hours per week) : 2 Hours per week			
Total no. of Lectures: 60 Hrs.			

Unit	Topics	No. of Lectures
1	**Introduction to programming:** Program concept, characteristics of programming, stages in program development, algorithms, notations, design, flowcharts, types of programming methodologies. **Basic of C++ :** A brief history of C++ , application of C++, compiling & linking, tokens, keywords, identifiers & constants, Basic data types, user-define data types, symbolic constant, types compatibility, reference variables, operator in C++, scope resolution operator, member dereferencing operator, memory management operators, manipulators, types 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.	**8**
2	**Classes & Objects:** A simple C++ program with class, defining member functions, making and outside function inline nesting of member functions, private member functions, arrays within a class, memory allocation for objects, object as function arguments, friend functions, virtual functions, returning objects, constant member functions, pointer to members, local classes. **Constructor & Destructor:** Constructor, Parameterized constructor, multiple constructor in a class, constructor with default arguments, dynamic initialization of objects, copy constructor, dynamic constructor and destructor.	**10**
3	**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.	**8**
4	**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-arrays and linked representations. **Stacks:** Operations, array and Linked implementations, application-infix to postfix conversion, infix to prefix conversion, postfix expression evaluation, recursion implementation.	**12**

	Queues: Definition, operation, array and linked implementations, circular Queue-insertion and deletion operations, dequeue (Double ended Queue). Priority Queue-implementation.	
5	**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.	**10**
6	**Graphs:** Graph ADT, graph representations, graph traversals, searching. **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.	**10**
7	**Indian contribution to the field:** Innovations in India, origin of Julia programming language, Indian engineers who designed new programming language, open source languages, Dr. Sartajsahni – Computer scientist – pioneer of data structures, other relevant contributors and contributions.	**2**

Part C- Learning Resources

Text Books, Reference Books, Other resources

Text Books:

- J.R. Hanly and E. B. Koffman, "Problem solving and program design in C". Pearson, 2015
- E. Balguruswamy, "C++", TMH Publication ISBN O-07-462038-X.
- HeabertShildt, "C++ the complete reference "TMH Publication ISBN 0-07-463880-7
- मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें

Reference Books:

- R. Lafore, Object Oriented programming C++"
- N. Dale and C. Weems, "Programming and problem solving with C++: Brief edition", Jones & Bartlett learning.
- Adam Drozdek, "Data structures and algorithm in C++", Third edition Cengage Learning.
- SartajSahani, 'Data structures, algorithm and Application with C++", McGraw Hill.
- Robert L. Kruse, "Data structures and Program Design in C++", Pearson.
- D.S. Malik, "Data structures using in C++", Second edition, Cengage Leaning.
- M.A. Weiss, Data structures and algorithm analysis in C++", 2nd edition, Pearson.
- Lipschutz, " Schaum's Outline series Data Structures", Tata McGraw-Hill.

Suggested digital platform web links:

https://www.youtube.com/watch?v+=BCIS40yzssA
https://www.youtube.com/watch?v=vLnPwxZdW4Y&vi=en
https://www.youtube.com/watch?v=Umm1ZQ5ltZw

Suggested equivalent online courses:

S.No.	Online Course	Duration	Platform
1	Programming in C++ https://nptel.ac.in/courses/106/105/106105151/	8 Weeks	**NPTEL**

<table>
<tr><td>2</td><td>Beginning C++ Programming–From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-programming/</td><td>Self paced</td><td>Udemy</td></tr>
<tr><td colspan="4">Part D- Assessment and Evaluation</td></tr>
<tr><td colspan="2">Internal Assessment:
Continuous Comprehensive Evaluation (CCE) :
Shall be based on allotted assignments and class tests. The marks shall be as follows:</td><td colspan="2">External assessment: University exam (UE):
Time: 02.00 Hours</td></tr>
<tr><td>Assessment and presentation of assignment</td><td></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Class Test I

(Objective Questions)</td><td></td></tr>
<tr><td>Class Test II

(Descriptive Questions)</td><td></td><td></td><td></td></tr>
<tr><td>Class Test III

(Based on solving programming problems)</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td>Total</td><td>100</td></tr>
<tr><td colspan="4">Any remarks / suggestions: Focus of the course/teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

Part A Introduction			
Program : Certificate	Class : BCA II SEMESTER	Year : 2022	Session : 2022-23

1	**Course Code**	S1-BCAA2P	
2	**Course Title**	Programming Methodology & Data Structure Lab	
3	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	Major – Paper II	
4	**Pre-Requisite (if any)**	The 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: • Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. • Writing efficient and well-structured computer algorithms/programs. • Learn to formulate iterative solutions and array processing algorithms for problems. • Use recursive techniques, pointers and searching methods in programming. • Process ability to choose a data structure to suitably model any data used in computer applications. • Implement and know the applications of algorithms for searching and sorting etc.	
6	**Credit Value**	**Practical – 2 Credits**	
7	**Total Marks**	Max. Marks : 100	Min. Marks : 40

Part B – Content of the Course

No. of Lectures (in hours per week) : 1 Hours per week

Total no. of Lectures: 30 Hrs.

Unit	Suggestive list of Practical	No. of Lectures
	Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. Write a program to swap the contents of two variables.	**30 Hrs.**

	2. Write a program for finding the roots of a quadratic Equation. 3. Write a program to find area of a circle, rectangle, square using switch 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 using recursion. 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 input 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 to 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 for implement linked list.	

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https://www.youtube.com/watch?v=Umm1ZQ5ltZw

Suggested equivalent online courses:

S. No.	Online Course	Duration	Platform
1	Programming in C++ https://nptel.ac.in/courses/106/105/106105151/	8 Weeks	**NPTEL**
2	Beginning C++ Programming–From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-programming/	Self-paced	**Udemy**

Part D- Assessment and Evaluation

Internal Assessment: **Continuous Comprehensive Evaluation (CCE) :** Shall be based on allotted assignments and class tests. The marks shall be as follows:		**External assessment: University exam (UE):** **Time: 02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hand-on Lab practice			
Viva			
Viva			
Lab Test from Practical			
Assignments (Chats / model) / Technology Dissemination / Excursion / lab visit / industrial training			
Total **Excursion / lab visit / Industrial** **Training is compulsory**		**TOTAL**	100