Sri Sathya Sai College for Women, Bhopal
(An Autonomous College Affiliated to Barkatullah University Bhopal)
Department of Higher Education, Govt. of M.P.
Under Graduate Syllabus (Annual Pattern)
As recommended by Central Board of Studies and approved by the Governor of M. P.
wef 2021-2022
(Session 2023-24)
(NEP-2020)

Class	B.C.A.
Year	I Year
Subject	Computer Applications
Course Title	Programming Methodology & Data Structures
Course Type	Core Course (Major II)
Credit Value	4
Max. Mark	30+70 (Minimum Marks 35)

Course Outcome: After the completion of this course, a student shall 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, search on these data structures.
- Possess ability to choose a data structure to suitably model any data used in computer applications.
- Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc.
- 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.

Particular

Unit 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.
Unit II	**Classes & Objects:** A Sample C++ Program with class, Defining Member Functions, Making an Outside Function Inline, Nesting of 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:** Constructor, Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor.
Unit III	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.
Unit IV	**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
Unit V	**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.
Unit VI	**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.
Unit VII	**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.

Suggestion Books:
- J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015
- E. Balaguruswamy, "C++ " TMH Publication ISBN O-07-462038-X
- Herbertz Schildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7

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.
- Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, Data Structure using C++, Second edition, Cengage Learning.
- M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson.
- Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill

Suggestive digital platform web links

- https://www.youtube.com/watch?v=BClS40yzssA
- https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en
- https://www.youtube.com/watch?v=Umm1ZQ5ltZw

Suggested equivalent online courses

- Programming in C++ https://nptel.ac.in/courses/106/105/16105151/
- Beginning C++ Programming – From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-plus-programming/

Scheme of Marks:

Maximum Marks: 100		
Continuous Comprehensive Evaluation (CCE): 30 marks, Term End Exam Theory: 70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE):	Class Test Assignment/ Presentation	30
External Assessment: University Exam Section Time:03.00 Hours	**Section (A)** Very Short questions **Section (B)** Short questions **Section (C)** Long questions	70
		Total 100

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Class	B.C.A.
Year	I Year
Subject	**Computer Applications**
Course Title	**Programming Methodology & Data Structures Lab**
Course Type	**Core Course (Major II)**
Credit Value	**2**
Max. Mark	**30+70 (Minimum Marks 35)**

Course Outcome: After the completion of this course, a student shall be able to do the following:
- 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.
- Possess ability to choose a data structure to suitably model any data used in computer applications.
- Implementation of algorithms for searching and sorting.

Particular

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.
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.

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

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- Beginning C++ Programming – From Beginner to Beyond
  https://www.udemy.com/course/beginning-c-plus-plus-programming/

Scheme of Marks:

Maximum Marks: 100		
Internal Assessment :	Class Interaction / Quiz Attendance Assignments (Charts / Model Seminar / Rural Service / Technology Dissemination / Report of Excursion / Lab Visits / Survey / Industrial visit)	30
External Assessment:	Viva Voce on Practical Practical Record File Table Work / Experiments	70
		Total 100