B.A. Part-III (COMPUTER SCIENCE) (Semester V) (Major)

PAPER CODE: BA514

DATA STRUCTURES

Total Marks: 70 Minimum Pass Marks: 35%
External Mark: 50 (Theory) Credit: 3
Internal Assessment: 20

Course Objectives

- Describe the concepts and operations of data structures for efficient data organization and manipulation .
- Design appropriate data structures and algorithms for real-world problem scenarios.
- Develop the ability to apply emerging data structures through continuous self-learning and practice.

Learning Outcome

- Implement linear and non-linear data structures.
- Understand fundamental data structures such as arrays, linked lists, stacks, queues, trees and graphs.
- Apply searching and sorting algorithms to organize and retrieve data efficiently.
- Evaluate the performance of different data structures.

A) Instructions for paper-setter

The question paper will consist of three sections, Sections A, B & C. Sections A & B will have four questions each from the respective sections of the syllabus out of which the student will be required to attempt two questions from each section. Each question will carry 8 marks, which may be segregated into sub-parts, Section C will be compulsory with 09 short answer type questions of 02 marks each, which will cover the entire syllabus.

B) **Instructions for candidates**

Candidates are required to attempt two questions each from sections A & B of the question paper and the entire section C.

SECTION A

Basic concepts and notations: Types of data structures, Data structure operations, Mathematical notations and functions, Algorithmic complexity, Big 'O' notation, Time and space trade off.

Arrays: Linear array, representation of array in memory, traversing linear array, insertion and deletion in an array, Two-dimensional array, row major and column major orders, sparse matrix.

Stacks: Representation of stacks in memory (linked and sequential), operations on stacks, Applications of stacks: string reversal, parentheses matching.

Queues: Representation of queues in memory (linked and sequential), operations on queues, insertion in rear, deletion from front.

SECTION B

Linked list: Representation of linked list using static and dynamic data structures, insertion and deletion of a node from linked list, searching in link list, searching in sorted link list.

Trees: Definition and basic concepts, linked representation and representation in contiguous storage, binary tree, binary tree traversal, Binary search tree, searching, insertion and deletion in binary search tree.

Searching and sorting algorithms: Linear and Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort.

Reference Books

1. Seymour Lipschutz, Theory and Practice of Data Structures, McGraw-Hill.
2. Vishal Goyal, Lalit Goyal, Pawan Kumar, A Simplified Approach to Data Structures, Shroff Publications.
3. Y. L. Tenenbaum, and A. J. Augenstein, Data Structures using C and C++, PHI.
4. Robert Sedgewick, Algorithms in C, Pearson Education.
5. Anshuman Sharma,Fundamentals of Data Structure

B.A Part-III (Semester V) Major
(COMPUTER SCIENCE)
Session 2026-27

PAPER CODE: BA514 (P)
SUBJECT: PRACTICAL BASED ON PAPER BA514

External Marks: 30 (20 Practical+10 internal) **Maximum Times: 2 Hrs.**
Minimum Pass Marks: 35% **Credit: 1**

This laboratory course will comprise as exercises to supplement what is learnt under paper BA-Data Structures. Students are required to develop ***following*** programs in C language with internal documentation

1 Program to insert an element in an array.
2 Program to delete an element from an array.
3 Program to store an array using sparse representation.
4 Program to apply various operations on stack.
5 Program for parenthesis matching using stack.
6 Program for String reversal using stack.
7 Program to insert and delete nodes in a queue.
8 Program to insert and delete nodes in a linked list.
9 Program to search a node in a linked list.
10 Program to insert or delete node in a binary tree.
11 Program to traverse binary tree.
12 Program for implementing linear search.
13 Program for implementing binary search.
14 Program for implementing Bubble sort.
15 Program for implementing Selection sort.
16 Program for implementing Insertion sort.
17 Program for implementing Quick sort.
18 Program for implementing Merge sort.

The breakup of marks for the University Examination will be as under:

Lab Record : 05 Marks
Viva Voce : 10 Marks
Practical Work : 05 Marks

B.A. Part-III (COMPUTER SCIENCE) (Semester VI)(Major)

PAPER CODE: BA614

OBJECT ORIENTED PROGRAMMING USING C++

Total Marks: 70 Minimum Pass Marks: 35%

External Mark: 50(Theory) Credit: 3

Internal Assessment: 20

Course Objectives

The objective of this course is to provide students with a strong foundation in C++ programming, including fundamental programming concepts, object-oriented programming, data structures, functions, classes, inheritance, polymorphism, exception handling, and file handling.

Learning Outcome

After completing this course, students will be able to:

1. **Understand** the fundamental concepts and syntax of C++ programming.
2. **Develop** C++ programs using variables, operators, control statements, functions, and arrays.
3. **Apply** object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and encapsulation.

A) Instructions for paper-setter

The question paper will consist of three sections, Sections A, B & C. Sections A & B will have four questions each from the respective sections of the syllabus. Each question will carry 8 marks, which may be segregated into sub-parts. Section C will be compulsory with 09 short answer type questions of 02 marks each, which will cover the entire syllabus.

B) Instructions for candidates

Candidates are required to attempt two questions each from sections A & B of the question paper and the entire section C.

Section A

Evolution of OOP: Procedure Oriented Programming, OOP Paradigm. Advantages and disadvantages of OOP over Functional Programming Approach.

Characteristics of Object Oriented Language: Classes, Objects, Inheritance, Reusability, User defined Data Types, Polymorphism and Exception Handling.

Introduction to C++: Structure of C++ Program, Identifier and keywords, Constants, Data Types, C++ Operators, Type Compatibility, Variable Declaration, Reference Variable, Statements, Expressions, Manipulators. Input and Output Statements.

Control Statements: Conditional Expression, Loop Statements,

Storage Class Specifiers: Automatic, Static, Register, Extern. Array, Pointer Arithmetic, Structures, Pointers and Structures, Unions, Bit Field Typed Enumerations.

Function in C++: Function Prototyping, Defining a function, Types of functions. Methods of **Parameter passing**: by value, by address, by reference, Recursion.

Function Overloading: Virtual functions, pure virtual functions, operator overloading.

Section B

Classes: Data members and member functions, objects, arrays of class objects, Objects as function arguments, nested classes, inline member functions, static data members and static member functions, friend functions, dynamic memory allocation.
Constructors and Destructors: Default parameterized and copy constructors, multiple constructors in classes dynamic constructors. Rules for constructors and destructors, Const. objects.
Inheritance: single inheritance, inheriting private members, types of derivation, multiple inheritance, multi-level inheritance, hierarchical inheritance, hybrid inheritance, container classes and member access control. Abstract class.
Polymorphism: Methods of achieving polymorphism behaviour.
Pointers: Pointers and classes, pointer to object, this pointer.

References:

1. Herbert Scheldt, The Complete Reference C++, Tata MeGraw-Hill, 2001
2. Bajane Stautrup, The C++ Programming Language, Addition,-Wesley Publication Co., 2001.
3. Stanley B. Lippman, Losee Lajoic, C++, Primer: Pearson Education, 2002
4. E. Balagurusamy. Object-Oriented Programming with C++, Tata McGraw-Hill, 2001
5. D. Ravichandran, Programming with C++ - 2nd edition, Tata McGraw-Hill Publishing Company Ltd.

B.A Part-III (Semester VI) COMPUTER SCIENCE (Major)
Session 2026-27

PAPER CODE: BA614 (P)
SUBJECT: PRACTICAL BASED ON PAPER BA

External Marks: 30 (20 Practical+10 internal) **Maximum Times: 2 Hrs.**
Minimum Pass Marks: 35% **Credit: 1**

This laboratory course will comprise as exercises to supplement what is learnt under paper BA-Data Structures. Students are required to develop following programs in C++ language with internal documentation

1. Write C++ program to print "Hello World!"
2. Write C++ program to add two numbers
3. Write C++ program to demonstrate various arithmetic operation (+, -, *, /, %, ^)
4. Write C++ Program to Check if Given Number is Positive
5. C++ program to Check Number is Divisible by 5 And 11
6. Write C++ Program to Check if Given Number is Odd or Even using Switch Case
7. Write C++ Program to Print First n Numbers using For loop
8. Write C++ Program to Print "Hello world" 10 Times using While loop
9. Write C++ Program to Initialize an Array in Program and Print it
10. Write C++ Program to Add Two Numbers using Recursion
11. Write C++ Program using friend function
12. Write C++ Program to explain the use of constructor and destructor
13. Write C++ Program to check function overloading by adding two numbers
14. Write C++ Program of this pointer
15. C++ Program to Illustrate Inheritance
16. C++ Program to Illustrate Multiple Inheritance
17. C++ Program to Illustrate Multilevel Inheritance with Method Overriding
18. C++ Program to Illustrate Pass by Value

The breakup of marks for the University Examination will be as under:

Lab Record	:	05 Marks
Viva Voce	:	10 Mark
Practical Work	:	05 Marks