

# Syllabus – C, C++, DSA

## Session 1 (Introduction to C Language)

- History of C Language
- Types of C Variables, The First C Program
- The C Character Set, Data Types and Ranges
- Type Declaration, Type Conversion
- Constant, Variables and Keywords
- Associativity of Operators
- Different Types of Operators with Examples

## Session 2 (The Decision Control Structure)

- The If Statement, The If-Else Statement
- The Nested of If-Else Statement
- Switch Statement and its various Conditions
- Nesting of If Statements
- Break statement and its examples

## Session 3 (The Loop Control Structure)

- Introduction to Loops and its Types
- Working with For Loop with Example
- Working with While Loop
- Continue, exit(0), goto statements
- Working with Do While Loop
- Nested of Looping (while, do-while, for)

## Session 4 (Arrays and Pointers)

- Introduction to Arrays
- Types of Arrays with Examples
- Working with 1-D, 2-D and 3-D Arrays
- Pointers and 1-D, Pointers and 2-D Array
- Pointers and 3-D Arrays
- Pointers to an Arrays, Arrays of Pointers

## Session 5 (Functions and Pointers)

- Introduction to Functions, Passing Values between Functions
- Function Declaration and Prototype

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- ❖ Live Classes

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- Function Returning Pointers
- Call by Value and Call by Address
- Recursion, Passing Arrays to Function
- Pointer to Function
- Function with Variable Number of Arguments

## Session 6 (Working with Structure)

- Why use structure, Declaring a structure
- Accessing Structure Elements
- Array of Structures, Uses of Structure, Typedef, BitFields
- Event Listeners Registration
- How Structure Elements are Stored
- Additional Features of Structure
- Enumerated Data Types
- Union and Union of Structures

## Session 7 (Working with File Input/Output)

- Data Organization, File Operations (Opening, Reading, Writing)
- File Opening Modes, String I/O in Files
- Text Files and Binary Files
- Working with Command Line Arguments
- Counting Characters, Tabs and Space
- Writing and Reading to/from Files
- Working with Low Level Disk I/O
- Working with Files Library Functions
- Low Level File Interaction

## Session 8 (The C Preprocessor Directives)

- Features of C Preprocessor, Macro Expansion, File Inclusion
- #if and #elif Directives, Macros with Arguments, Macros with Functions
- Conditional Compilation, #undef and #pragma Directives

## Session 9 (Principles of Object Oriented Programming)

- Object Oriented Programming Paradigm, Basic Concepts of OOPS
- Benefits of OOP, Object Oriented Languages
- Application of OOP

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## Session 10 (Beginning with C++)

- What is C++, Application of C++
- A Simple C++ Program, Creating the Source File
- More C++ Statements, An Example of Class
- Structure of C++ Program, Compiling and Linking

## Session 11 (Tokens, Expressions and Control Statements)

- Tokens, Keywords, Identifiers and Constant
- Basic Data Types, User Defined Data Types
- Derived Data Types, Declarations of Variables
- Dynamic Initialization of Variables, Reference Variables
- Operator Precedence, Operators in C++
- Scope Resolution Operator, Member De-referencing Operators
- Memory Management Operators, Manipulators, Type Cast Operators
- Expression and Their Types
- Implicit Conversion, Operator Overloading
- Control Statements and Looping

## Session 12 (Functions in C++)

- The Main Function, Function Prototyping
- Return by Reference, Inline Function
- Friend and Virtual Functions
- Call by Reference, Function Overloading
- Default Arguments, Const Arguments
- Math Library Functions

## Session 13 (Classes and Objects)

- Introduction to C++, A C++ Program with Class
- Defining Member Functions, Nesting of Member Functions
- Private Member Functions, Static Data Members, Static Member Functions
- Friend Functions, Returning Objects, Making an Outside Function Inline
- Arrays within a Class, Memory Allocation for Objects
- Arrays of Objects, Object as Function Arguments
- Constant Member Functions, Pointer to Members, Local Classes

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## Session 14 (Constructors and Destructors)

- Introduction to Constructors, Multiple Constructors in Class
- Dynamic Initialization of Objects
- Dynamic Constructor, Const Objects
- Parameterized Constructor
- Constructors with Default Arguments, Copy Constructor
- Constructing Two-Dimensional Arrays
- Destructors and its Properties

## Session 15 (Operator Overloading and Type Conversion)

- Defining Operator Overloading
- Overloading Unary and Binary Operators
- Manipulation of Strings using Operators
- Overloading Binary Operators using Friend
- Examples of Overloading Operators
- Rules for Overloading Operators, Type Conversions

## Session 16 (Inheritance: Extending Classes)

- Defining Derived Classes, Single Inheritance
- Making Private Member Inheritance, Multi-level Inheritance
- Constructors in Derived Classes, Multiple Inheritance
- Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes
- Abstract Classes, Member Classes: Nesting of Classes

## Session 17 (Pointers, Virtual Functions and Polymorphism)

- Pointers, Pointers to Objects, this Pointers
- Pure Virtual Functions, Pointers to Derived Classes
- Virtual Functions

## Session 18 (Managing Console I/O Operations)

- C++ Streams, C++ Stream Classes
- Unformatted I/O Operations, Formatted Console I/O Operations
- Managing Output with Manipulators

## Session 19 (Working with Files)

- Classes for File Stream Operations, Opening and Closing a File

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- Detecting end of the file, File Modes, More about open(), Command Line Args
- File Pointers and Their Manipulators
- Sequential Input and Output Operations
- Updating a File: Random Access
- Error Handling During File Operations

## Session 20 (Template Programming)

- Introduction to Template, Class Templates, Function Templates
- Class Templates with Multiple Parameters
- Function Templates with Multiple Parameters
- Overloading of Templates, Member Function Templates
- Non-Type Template Arguments

## Session 21 (Exception Handling)

- Basic of Exception Handling
- Exception Handling Mechanism, Throwing Mechanism
- Caching and Re-throwing Exception

## Session 22 (Manipulating Strings)

- Introduction to Strings, Creating Strings Objects
- Manipulating String Objects, Relational Operators, String Characteristics
- Accessing Characters in Strings, Comparing and Swapping of Strings

## Session 23 (Introduction to Standard Template Library)

- Introduction to STL and its Components, Application of Container Classes
- Containers, Iterators, Algorithms, Function Objects
- Working with Namespaces
- Introduction to STL Classes

## Session 24 (Introduction to Data Structures and Algorithms)

- Data Structure Introduction and Classification
- Algorithm Efficiency, Abstract Data Types and Algorithms
- Notation: (Big-O, Omega and Theta)
- Time and Space Complexity, Worst Case, Average Case and Best Case

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## Session 25 (Linked Lists)

- Introduction to Linked List Types of Linked List with its operations
- Linked List versus Arrays, Application of Linked List
- Memory Allocation and De-allocation
- Polynomial Representation

## Session 26 & 27: Stacks and Queues

- Introduction to Stacks, Arrays Representation of Stacks
- Operation on a Stack: Push(), Pop() and Peek()
- Linked List Representation of Stack
- Push, Pop and Peek Operation with Linked List
- Multiple Stacks, Application of Stacks
- Evaluation of Arithmetic Expression, Infix to Postfix Conversion
- Introduction to Queues, Arrays and List Representation of Queue
- Types of Queues with Examples
- Application of Queues, Circular Queue
- Dequeue, Priority Queue, Multiple Queue Examples

## Session 28 (Trees)

- Introduction to Trees, Types of Trees, Tree Traversal
- In-Order, Post-Order and Pre-Order
- Introduction to Binary Search Tree, Operations with Binary Search Tree
- Threaded Binary Tree, AVL Tree and Its Rotations
- B and B+ Trees

## Session 29 (Graphs)

- Introduction to Graphs, Graph Terminology
- Directed Graphs and its Terminology, Representation of Graph
- Adjacency Matrix Representation, BFS and DFS Searching Algorithm
- Shortest Path Algorithms, Minimum Spanning Trees
- Prim's and Kruskal's Algorithm, Dijkstra's Algorithm and Application of Graphs

## Session 30 (Heaps, Searching and Sorting)

- Introduction to Heaps and its Applications, Introduction to Sorting Algorithms

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- Bubble Sorting, Selection Sorting, Insertion, Merge, Quick and Heap Sorting
- Linear Search and Binary Search
- Hash Table, Hash Function and Collisions in Hashing
- Type of Techniques for Collision Resolutions

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