*Suggested Teaching Guidelines for*

PROGRAMMING CONCEPTS

PG-DIPLOMA IN HPC APPLICATION PROGRAMMING ( PG-DHPCAP)

**Duration:**  Class Room hrs. + Labs hrs. (120 hrs.)

**Objective:** To reinforce knowledge of basic programming language concepts.

**Prerequisites:** Familiar with Programming Concepts and Problem Solving Skills

**Evaluation method:** Theory exam– 80% weight age

Internal – 20%

**List of Books / Other training material**

**TextBook:**

1. Software Engineering by Chandramouli / Pearson

# Let Us C : Authentic guide to C programming language (18th Edition) by Y.Kanetkar

# Object Oriented Programming with C++ by Balguruswamy

1. Data Structures & Algorithms by Aho
2. Concise Fortran by [Obi Somuadina C.](https://www.amazon.com/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Obi+Somuadina+C.&text=Obi+Somuadina+C.&sort=relevancerank&search-alias=books)
3. Core Java Volume I--Fundamentals: 1 by Cay Hortsmann.

**Reference Book:**

1. Software engineering by Ian Sommerville / Pearson

# .C++: The Complete Reference, 4th Edition by Herbert Schildt

# The C++ Programming Language (4th Edition) By Bjarne Stroustrup

# C Programming Language (2nd Edition) By Brian W. Kernighan & Dennis M. Ritchie

1. 1. Introduction to Algorithms by Cormen, Leiserson, Rivest and Stein
2. 2. Data Structures and Algorithm Analysis in Java, Mark A. Weiss
3. Core and Advanced Java Black Book by Dreamtech Press
4. 2.Beginning Java 2 by Ivor Horton; Wrox Publication
5. 3.Object-oriented Analysis And Design Using Uml an Introduction To Unified Process And Design Patterns 1st Edition by Mahesh P. Matha / PHI

**C PROGRAMMING**

**Session 1**

**Lecture**

Introduction to C

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Data Types, Variables, Constants

Operators

Conditional Statements and Loops

Array

**Assignment - Lab**

[Write a C program to perform input/output of all basic data types](https://codeforwin.org/2017/08/c-program-perform-input-output-basic-data-types.html).

[Write a C program to enter two numbers and perform all arithmetic operations.](https://codeforwin.org/2015/05/c-program-to-perform-all-arithmetic-operations.html)

**Session 2**

**Lecture**

String

Pointers

Functions

Structure and Union

Recursion

**Assignment - Lab**

C program to change string to upper case without strupr.

Check number is prime or not using function.

Find LCM of numbers using recursion.

**C++ PROGRAMMING**

**Session 3**

**Lecture**

C vs C++

Data Types, Variables, Constants

Operators

Access Specifiers

Conditional Statements and Loops

**Assignment - Lab**

Write a program to print HELLO WORLD on screen.

Write a program to swap the values of two variables without using third variable.

Any year is input by the user. Write a program to determine whether the year is a leap year or not.

**Session 4**

**Lecture**

Arrays

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Strings

Functions

Pointers & References

**Assignment - Lab**

Write a C++ program to reverse the element of an integer array.

Write a program to count number of words in string.

Write a program to check character entered is alphabet, digit or special character using library functions.

Print the address of the variables defined.

**Session 5**

**Lecture**

Constructors and Destructors

Introduction to OOP concepts

Encapsulation

Inheritance

**Assignment - Lab**

Create demo applications to illustrate different types of inheritance.

Create demo class and encapsulate all members.

**Session 6**

**Lecture**

Abstraction

Polymorphism

Function Overloading

Operator Overloading

**Assignment - Lab**

Create a demo function and override it.

**ALGORITHM AND** **DATA STRUCTURES using** **C PROGRAMMING**

**Session 7,8**

**Lecture**

Algorithms :

Basics of algorithms (Asymptotic Notations, Complexities)

Searching algorithms (Sequential, Binary)

Sorting algorithms (Bubble, Quick, Heap, Merge)

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**Assignment - Lab**

Implement to find an item in a list through binary search.

Implement sorting algorithm for selection sort, Bubble sort, heap sort and quick sort.

**Session 9,10**

**Lecture**

Data Structures:

Basic Data Structures

-Arrays

-Stacks

-Queues

-Linked Lists

**Assignment - Lab**

Implement Stack using Arrays/Linked list

**Session 11,12**

**Lecture**

Advanced Data Structures

-Trees

Tree Traversals

Types of Trees(Binary,CompleteBinary etc)

-Graphs

Graph terminologies

Graph representations

**Assignment - Lab**

Write a program to implement a binary search tree and the following operations on it:

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Create() ,InsertNode() ,Tree traversals ( Inorder(), Preorder(), Postorder() ), deleteNode()

**FORTRAN PROGRAMMING**

**Session 13**

**Lecture**

Introduction to Fortran programming

Data Types

Variables, Constants, Operators

Conditional and Looping Statements

**Assignment - Lab**

Write a program which writes out the square root of every whole number from 1 to 5.

Write a program using a loop which gives a Celsius to Fahrenheit conversion table in units steps from 0oC to100oC. (To get degrees oF, multiply oC by 9/5, then add 32; to check your result, note that water freezes at 32oF and boils at 212oF.)

**Session 14,15**

**Lecture**

Arrays

Strings

Pointers

Functions and Subroutines

Derived Data Types

Modules

**Assignment – Lab**

Write a program to read some numbers from the terminal and store them in an array. Print out the array to check they were entered correctly. (You must specify the maximum size of the array, since the F77 compiler needs to do know how much memory to allocate to the program).

Write a function to compute the factorial n!=1\*2\*⋯\*n of a given integer number n (we can fix this number, say n=10).

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**Session 16**

**Lecture**

Interface Formatting

-Formatting features

- Formatted READ

- Formatted WRITE

File Handling

-Basics of file i/o

-Internal files

-External files

**Assignment - Lab**

You are given a data file with xyz coordinates for a bunch of points. The number of points is given on the first line. The file name of the data file is points.dat. The format for each coordinate is known to be F10.4.

**JAVA PROGRAMMING**

**Session 17**

**Lecture**

About main () method

Java Data Types, Primitives and Binary Literals

Data type compatibility and casting of primitive data types

Static variables and methods

Accessing static variables and methods of different class

Final variables

**Assignments – Lab**

Write a Java programs to

Print Hello World

Add two numbers/binary numbers/characters

Calculate compound interest

Calculate power of a number

Swap two numbers

**Session 18,19**

**Lecture**

Operators

Conditional and Looping Statements

Static

Arrays

String class (String builders, string buffers)

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**Assignments – Lab**

Find square root of a number without sqrt method

Check Armstrong number

Calculate grades of students using their marks

Use switch case, recursion, print patterns, etc.

Reverse a array without using predefined function.

Sort an integer array.

**Session 20,21**

**Lecture**

Object Oriented Concepts

Class and Objects

Encapsulation

Inheritance

Polymorphism

Abstraction

**Assignments – Lab**

Create Java Program for simple calculator, compile & test it.

Create Emp class with its suitable data members. Inherit People class and derive its properties in emp class.

**Session 22,23**

**Lecture**

Interfaces

Abstract Classes

Packages

Java.lang package

**Assignments – Lab**

Read java docs and observe packages,classes and interfaces.

**Session 24,25**

**Lecture**

Java.util package

Exception Handling

Exception Hierarchy

Try,Catch,Throw,Throws,Finally

Custom Exceptions

**Assignments – Lab**

Create custom exception class for supporting validation rules in customer scenario.

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**Session 26**

**Lecture**

Garbage collection in java

Requesting JVM to run garbage collection

Different ways to make object eligible for garbage collection: (Nulling a reference variable, Re-assigning a reference variable & island of isolation)

Finalize method

**Assignments – Lab**

Override finalize method to understand the behavior of JVM garbage collector

**Session 27,28**

**Lecture**

Multithreading

Java.awt package

**Assignments – Lab**

Apply multi-threading techniques to File handling & ensure thread safety.

Using thread safe vs thread un safe collections.

**Session 29**

**Lecture**

Java.io package

Object class overview

**Assignments – Lab**

Apply multi-threading techniques to File handling & ensure thread safety.