



AN INTRODUCTION TO PROGRAMMING THROUGH C++

PROF. ABHIRAM G. RANADE

Department of Computer Science
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Standard XII in the Science stream.

INTENDED AUDIENCE : First and second year students in degree programs including Engineering and Science degree programs.

INDUSTRIES APPLICABLE TO : Basic programming is of value to all. C++ allows you to design very fast programs and access low level machine features, but at the same time its libraries provide a very high level programming model. It can be considered a modern, safer version of the C language.

COURSE OUTLINE :

This course provides an introduction to problem solving and programming using the C++ programming language. The topics include: Basic programming notions. Control flow, variables and assignments state-ments, conditional execution, looping, function calls including recursion. Arrays and structures. Elementary aspects of classes. Heap memory. Program design. How human beings solve problems manually. Strategies for translating manual strategies to computer programs. Organizing large programs into units such as functions and classes. Introduction to assertions and invariant. Programming applications. Arithmetic on polynomials, matrices. Root finding. Sorting and searching. Design of editors and simulators, including graphical editors. Elementary animation. A rudimentary graphics system will be discussed. Standard Library of C++. The string, vector and map classes.

ABOUT INSTRUCTOR :

Prof. Abhiram G. Ranade is a Professor of Computer Science and Engineering at IIT Bombay. He obtained a B. Tech. degree in Electrical Engineering from IIT Bombay in 1981. In 1988 he obtained a Ph.D. in Computer Science from Yale University, USA. He was an Assistant Professor of Electrical Engineering and Computer Science at the University of California, Berkeley, USA during 1988-94. Since 1995 he has been a faculty member in IIT Bombay. His research interests are Algorithms, Combinatorial Optimization, Scheduling in Transportation Systems, and Programming Education. He has won Excellence in Teaching Awards of IIT Bombay in 2006-7 and 2010-11.

COURSE PLAN :

Week 1: Introduction to computers using graphics. Notions of program organization, control flow.

Week 2: Basic data types. Variables. Assignment statement. Introduction to program design using examples such as summing infinite series.

Week 3: Statements of C++ for conditional execution and looping.

Week 4: Applications such as computing mathematical functions, root finding.

Week 5: Functions. Parameter passing. Recursion. Correctness issues.

Week 6: Recursive algorithms and recursive drawings. Breaking larger programs into functions.

Week 7: Arrays. Basic array processing strategies including passing arrays to functions. Pointers. Applications illustrating use of arrays to store sets and sequences. Iterating over pairs of objects from an array, Selection sort.

Week 8: Use of arrays to represent textual data. Multidimensional arrays. Command line arguments. Binary search. Merge sort.

Week 9: Structures. Pointers with structures. Structure examples.

Week 10: Dynamic memory allocation. Basic mechanisms and pitfalls.

Week 11: Use of the standard library in designing programs. Design of medium size programs.

Week 12: A program for designing and solving resistive circuits with a graphical user interface.