

Approval: 9th Senate Meeting

IIT Mandi

Proposal for a Modification in Old Course

Course Name: Programming and Data Structure Practicum

Course Number: IC 250

Credits: 1-0-3-3

Prerequisite: IC150

Students intended for: B.Tech 1st and 2nd

Elective or Core: Institute Core

Semester: Even/Odd

Course objective:

Computing is an indispensable tool for all engineers. In IC150, students learn the basics of computing, became proficient in a widely used programming language such as C and gain exposure to tools including Octave/Sci lab and spreadsheets. This second computing course introduces students to a range of useful data structures. The emphasis is on choice of data structures and use of existing libraries to solve engineering problems. Design and Implementation of data structures is not a goal. Efficiencies of execution and memory usage is important. Students will learn how to calculate asymptotic complexity. They will learn how to measure actual execution time and memory usage.

Course Contents:

Introduction to data structures, abstract data types, Creation and manipulation of data structures: arrays, lists, stacks, queues, trees, heaps, hash tables, balanced trees. Algorithms for sorting and searching. Notion of time and space complexity, the O- notation

- Introduction: Role of algorithms in Computing, analyzing algorithms and designing algorithms
[2 Lectures]
- Data Structures: Stacks, queues, linked lists, rooted trees, B-tree, graphs, hash tables, recursion
[6 Lectures]
- Sorting and searching algorithms: Bubble, Heapsort, Quicksort, Sequential Searches, Binary search
[4 Lectures]
- Efficiency: Time and Space complexity, O-Notation, Space time trade-off, Measuring execution time, memory usage,

[2 Lectures]

Lab Exercises:

- Lab to be conducted on a 3-hour slot. It will be conducted in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course should be appropriately be sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below
- Two assignments: Designing algorithm for some problems and writing program for it
- Four-Five assignments (some examples: Building a queue of strings, practice with linked data structures, Using a stack to evaluate arithmetic expressions etc),
- Two-Three assignments: sorting with recursion etc
- Four-Five assignments: Comparing time and space complexity, e.g, comparing sorting by minimum search and sorting by mergesort, Analysing NP hard and NP complete problems and dealing with them

Text Book:

1. Introduction to Algorithms-Thomas H.Cormen, Leiserson, Rivest, Stein (Text Book)

References

2. Data Structures and Algorithms, By: Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft