UNIVERSITY OF MADRAS
B.Sc. DEGREE PROGRAMME IN COMPUTER SCIENCE
SYLLABUS WITH EFFECT FROM 2023-2024

Year: I	Semester: II
Problem Solving Techniques	**125S2B**
Credits 2	**Lecture Hours:2 per week**

Learning Objectives: (for teachers: what they have to do in the class/lab/field)
- To understand the importance of algorithms and programs, and to know of the basic problem-solving strategies.
- To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems.

Course Outcomes: (for students: To know what they are going to learn)
CO1: Understand the systematic approach to problem solving.
CO2: Know the approach and algorithms to solve specific fundamental problems.
CO3: Understand the efficient approach to solve specific factoring-related problems.
CO4: Understand the efficient array-related techniques to solve specific problems.
CO5: Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.

Units	Contents
I	Introduction: Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.
II	Fundamental Algorithms: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.
III	Factoring Methods: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the nth Fibonacci number.
IV	Array Techniques: Array order reversal – Array counting or histograming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the kth smallest element – Longest monotone subsequence.
V	Text Processing and Pattern Searching: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search.Recursive algorithms: Towers of Hanoi – Permutation generation.

Learning Resources:

Recommended Texts

1. R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007.

Reference Books

1. George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013).

2. Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996.

Web resources