



Sub Committee - Specialization for Curriculum Development

Post Graduate/ Under Graduate

Course Title: Design and Implementation of Algorithms

Course Code:

Number of Credits: 4

Level: 3

Learning Objective/Outcome (s): This course aims to introduce the formal techniques to support design and analysis of algorithms, focusing on the mathematical theory. The aim of this course is also to make the students learn how to develop efficient algorithms for simple computational tasks and reason about the correctness of them. It also aims to introduce the concept of graphs and heaps.

At the end of this course, the student should be able to:

1. Implement the various data structures learnt in the prerequisites and understand how the data structure and algorithm design methods impacts the performance of programs.
2. Design effective and efficient algorithms for various computing problems.
3. Determine space and time complexity of algorithms
4. Understand Recursion and its benefits
5. Use various design techniques(divide and conquer, greedy etc.)

Pre-learning:

Student should be familiar with basic data structures such as array, list, tree, binary heap and graph.

Knowledge about any programming language

Fundamental knowledge of networking

Pedagogy:

Class Room

Computer Programs for implementing concepts

Tutorials

Course Outline:

Sr. No.	Topic	Hours.
1	Data Structure Fundamentals: Review of basic data structures -Stack and Queue, Link list and Trees and its traversal. Review of basic algorithms.	4

2	Performance Analysis: Basic Algorithm Analysis: Space complexity and Time complexity Different Analysis Approaches: posteriori testing, and ap riori approach Asymptotic Notations (O , Ω , Θ) Average, Best and Worst case behaviours of algorithms.	8
3	Sorting and search algorithm for find out the average, best and worst complexity: - Merge Sort Quick Sort Bucket Sort Binary Search	8
4	Recursion Mathematical Analysis of Non-recursive Algorithm – Mathematical Analysis of Recursive Algorithm through Recurrence relations.	8
5	Algorithm Design Strategies: Divide and Conquer Algorithms Greedy Algorithms Branch and Bound Backtracking	16
6	Graphs: Graphs-Definitions Implementation of Graphs using Adjacency Matrix and Adjacency Lists. Traversal of Graphs: Breadth First Search(BFS) and Depth First Search(DFS) Minimum Spanning Trees. Growing a minimum spanning tree The algorithms of Kruskal and Prime Single-Source Shortest Paths Dijkstra’s Algorithm	12
7	Introduction to NP-Hard and NP-Complete Problems	4
	Total	60

Books Recommended:

1. Introduction to The Design & Analysis of Algorithms, Anany Levitin, 2nd Edition, Pearson Education, 2007.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 2nd Edition, PHI, 2006.
3. Computer Algorithms by Horowitz E., Sahni S., Rajasekaran S., Galgotia Publications, 2001.

Suggested Assessment/ Evaluation Methods

Written Exam
Project Work
Assignments
Quiz

Benchmarked against similar courses in other national/ international universities /organizations

S. No.	Name of the Course	Name of University where it is offered
1	Design and Analysis of Algorithms	Savitribai Phule Pune University
2	Design and Analysis Of Algorithms	Anna University
3	Design and Analysis of Algorithms	Gujarat University

Name of Members					
Designation					
Org. / Inst.					
Signature					

Name of Experts					
Designation					
Org. / Inst.					
Signature					

Signature of Dean:

Date: