

6 <sup>TH</sup> SEMESTER BSc. CS(H)			
	SUB CODE		SUB NAME
MAJOR	CORE-I	PAPER-14	Algorithm Design Techniques
	CORE-I	PAPER-15	Project Work-I
MINOR	CORE-III	PAPER-3	Electricity & Magnetism
SEC	PAPER-3		
VAC	PAPER-4		

**Semester- VI**  
**Algorithm Design Techniques**

## Course Objectives:

- To understand the importance of algorithm design.
- To learn ways to analyze algorithms
- To learn about adoption of different algorithmic styles for solving different types of problems

## Learning Outcomes:

Upon completion of this course, students will be able to:

- Learn approaches to algorithm analysis & design
- Learn different searching and sorting techniques
- Learn greedy techniques for problem-solving
- Learn graph-based techniques for practical problem-solving

## Unit-I:

Algorithm specification: Pseudo code, Asymptotic Analysis, Space complexity and time complexity, Analysis and design of Insertion sort algorithm, Divide and Conquer paradigm, Recurrence relations, Solving Recurrences: Substitution methods, Recursion tree method, and Master method.

## Unit-II:

Searching and Sorting: Analysis of Linear Search, Binary Search, Merge Sort and Quick Sort, Heap Sort. Hashing: Hash functions, Hash table, Collision resolution: Chaining and Open Addressing (Linear probing, Quadratic probing, Double hashing).

## **Unit-III:**

Greedy Technique: General Method, Applications: Fractional Knapsack Problem, Job Sequencing with Deadlines, Huffman Codes.

Dynamic Programming: General Method, Applications: Matrix Chain Multiplication, longest common subsequence, 0/1 Knapsack.

## **Unit-IV:**

Graph Algorithms, Topological sort, Minimum Spanning Trees: Prim's and Kruskal's algorithm, Single-source shortest paths: Bellman-Ford algorithm, Dijkstra's algorithm.

### **Text Book:**

- ✓ *Introduction to Algorithms*, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, PHI.
- ✓ *Fundamentals of Computer Algorithms*. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, University Press

### **Reference Book:**

*Algorithm Design*, by Jon Kleinberg, Eva Tardos.

## **Core XIV- Lab: Algorithm Design Techniques**

1. Write C / C++ Program to implement Insertion Sort
2. Write C / C++ Program to implement Merge Sort
3. Write C / C++ Program to implement Quick Sort
4. Write C / C++ Program to implement Heap Sort
5. Write C / C++ Program to implement Hashing
6. Write C / C++ Program to implement Fractional Knapsack
7. Write C / C++ Program to implement Matrix Chain Multiplication
8. Write C / C++ Program to implement Longest Common Subsequence
9. Write C / C++ Program to implement Prim's Algorithm
10. Write C / C++ Program to implement Krushkal's Algorithm
11. Write C / C++ Program to implement Dijkstra's Algorithm

A student has to do a Project work under the guidance of a faculty member. After completing the project, the student has to submit a project report which has to be evaluated by an external examiner. The model template for the project report can be as follows:

1. Title of the project
2. Declaration (by the student)
3. Certificate (of the project guide)
4. Acknowledgement
5. Abstract  
[Provide a brief summary of your project, including its objectives, methods, and key findings.]
6. Table of Contents  
Introduction  
Literature Review  
Methodology  
Results  
Discussion  
Conclusion  
References
7. Introduction  
[Describe the background and context of your project, including the problem statement and objectives.]
8. Literature Review  
[Review relevant literature related to your project, discussing previous research, theories, and concepts.]
9. Methodology/  
[Explain the methods you used to conduct your research or project, including data collection, analysis techniques, and any tools or software used.]
10. Implementation/Software development
11. Results  
[Present the findings of your research or project, using tables, figures, or graphs as needed to illustrate key points.]
12. Discussion  
[Interpret your results and discuss their implications, relating them back to your research objectives and the broader context of your field.]
13. Conclusion  
[Summarize the main findings of your project and their significance, as well as any recommendations for future research or applications.]
14. References  
[List all sources cited in your project using a consistent citation style (e.g., APA, MLA).]

The evaluation pattern of the project will be as follows:

- i. Problem formulation and definition
- ii. Execution of code & results
- iii. Documentation
- iv. Clarity in presentation
- v. Performance in the Viva voce