CSC-322: Design and Analysis of Algorithms

General Information

Course Number	**CSC-301**
Credit Hours	3 (Theory Credit Hour = 3)
Prerequisite	Data Structure
Course Coordinator	Not Specified

Course Objectives

This course teaches fundamental principles of the design and analysis of algorithms. The topics include main design techniques such as brute force, divide and conquer, space and time trade-offs, and greedy algorithms as well as fundamentals of the analysis of algorithm efficiency, limitations of algorithmic power and approximation algorithms.

Catalog Description

CSC-222

Course Content

Weeks	Topics	Task/Reading *(author/chapter)*
1	**Introduction** Fundamentals of algorithmic problem solving. Important problem types. Fundamental data structures.	(Cormen/Chapter 1 and 10) (Levitin/Chapter 1)
2	**Fundamentals of the analysis of algorithm efficiency** The analysis framework. Asymptotic notations and basic efficiency classes, growth of functions.	(Cormen/Chapter 3) (Levitin/Chapter 2)
3,4	Mathematical analysis of algorithms. Empirical analysis of algorithms, analysis framework for iterative algorithms, analysis framework for recursive algorithms, solving recursive relations by substitution methods, recursion tree and master theorem	(Cormen/Chapter 2, 4) (Levitin/Chapter 2)
5	**Brute force algorithms** Selection sort and bubble sort. Sequential search. Closest pair problems. Exhaustive search, Travelling salesman problem and Knapsack problem.	(Cormen/Chapter 2) (Levitin/Chapter 3)
6	**Decrease and conquer algorithms** Insertion sort. Decrease by a constant factor algorithm. Variable size decrease algorithms.	(Cormen/Chapter 2) (Levitin/Chapter 4)
7	**Divide and conquer algorithms** Merge sort. Quicksort. Matrix multiplication	(Cormen/Chapter 4) (Levitin/Chapter 5)
8	**Transform and conquer algorithms** Binary search trees. AVL and Red-Black Trees, Heaps and heapsort.	(Cormen/Chapter 6, 12, 13, 18) (Levitin/Chapter 6)
9	**Midterm Examination**	

10	**Hash Tables** Direct-address tables, Hash tables, Hash functions. Complexity of hash tables.	(Cormen/Chapter 11) (Levitin/Chapter 7)
11	**Elementary Graph Algorithms** BFS, DFS, Topological Sort	(Cormen/Chapter 22) (Levitin/Chapter 4)
12	**Greedy algorithms** Huffman code, Prim's algorithm	(Cormen/Chapter 16,23) (Levitin/Chapter 9)
13	Kruskal's algorithm.	(Cormen/Chapter 16,23) (Levitin/Chapter 9)
14	**Shortest Paths Algorithms** Dijkstra's algorithm	(Cormen/Chapter 21) (Levitin/Chapter 10)
15	Bellman Ford Algorithm	(Cormen/Chapter 21) (Levitin/Chapter 10)
	Revision	
	Final Examination	

Text Book

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L., Stein, C. (2009) Introduction to Algorithms. 3rd Edition. Cambridge, Massachusetts London, England: The MIT Press.
2. Levitin, A. (2012) Introduction to the Design and Analysis of Algorithms. 3rd Edition. USA: Addison-Wesley.

Reference Material

1. Heineman, G. T., Pollice, G., & Selkow, S. (2016). Algorithms in a Nutshell: A Practical Guide. " O'Reilly Media, Inc.".
2. Sedgewick, R., Wayne, K. (2011) Algorithms. 4th Edition. NJ: Addison-Wesley.

Course Learning Outcomes

	Course Learning Outcomes (CLO)
1	To understand the fundamental concepts of algorithms
2	To analyze the well-known computing algorithms
3	To solve problems using algorithm design strategies in general and estimate the computational limitations

CLO-SO Map

	SO IDs											
CLO ID	**GA1**	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CLO 1	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CLO 2	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CLO 3	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Approvals

Prepared By	
Approved By	Not Specified
Last Update	2025