



COMSATS University Islamabad

Department of Computer Science

Course Description Form (CDF)

Course Information

Course Code: **CSC301**

Credit Hours: **3(3,0)**

Lab Hours/Week: **0**

Course Title: **Design and Analysis of Algorithms**

Lecture Hours/Week: **3**

Pre-Requisites: **CSC211-Data Structures and Algorithms**

Catalogue Description:

This course is designed to provide comprehensive knowledge of algorithms with an understanding of the principles and techniques used in the design and analysis of algorithms. The topics covers include Overview of Algorithm; Proving Correctness of Algorithms; Asymptotic Notations; Solving Recurrence Relations; Sorting & Order Statistics; Brute Force Algorithms & their Analysis; Divide and Conquer; Dynamic Programming; Greedy Algorithms; Graph; Basic Computability.

Unit wise Major Topics:

Unit	Topic	No. of teaching hours
1.	Overview of Algorithm: Concepts, Properties, Algorithm Design & Analysis Process.	3
2.	Proving Correctness of Algorithms: Pre-conditions, Post-conditions, correctness of Iterative & Recursive Algorithms.	4.5
3.	Asymptotic Notations: Big O, Sigma, Theta, Worst, Best & Average Case Behavior of Algorithms; Complexity Classes; Analysis of Iterative Algorithms; Time and Space Tradeoffs.	4.5
4.	Solving Recurrence Relations: Substitution Method, Recurrence Tree Method, Master Method, and Analysis of Recursive Algorithms.	4.5
5.	Sorting and Order Statistics: Merge Sort & its Analysis, Quick Sort & its Analysis, Randomized Quicksort, Heap Sort & its Analysis, Sorting in Linear Time: Lower Bounds for Sorting, Counting Sort, and Radix Sort.	4.5
6.	Brute Force Algorithms and their Analysis: Pattern Matching Algorithm, Closest-Pair & Convex-Hull Problems.	3
7.	Dynamic programming (DP): Component & Properties; Edit Distance; Longest Common Subsequence (LCS); The Knapsack Problem; Optimal Binary Search Trees; Matrix Chain Multiplication.	9
8.	Greedy Algorithms: Huffman Encoding, Disjoint Subsets & Union-Find Algorithms	3
9.	Graphs Algorithms: Directed Acyclic Graph (DAG), Topological Sorting, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Paths Problem, The Maximum-Flow Problem.	6
10.	Basic Computability: The Complexity Classes P & NP; Introduction to NP Complete Problems.	3
Total Contact Hours		45

Mapping of CLOs and SOs				
Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	SO
CLO-1	1-2	Apply inductive proofs techniques to prove the correctness of an algorithm.	<i>Applying</i>	1,2
CLO-2	3-5	Analyze the behavior of an algorithm using asymptomatic analysis.	<i>Analyzing</i>	2
CLO-3	6-8	Design an algorithm for a computational problem by employing an appropriate algorithmic approach.	<i>Creating</i>	2,3
CLO-4	9	Explain the concept of computability with examples.	<i>Understanding</i>	1
CLO Assessment Mechanism				
Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4
Quizzes	Quiz 1	Quiz 2	Quiz 3 &4	-
Assignments	Assignment 1	Assignment 2	Assignment 3 &4	-
Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-
Final Term Exam	Final Term Exam			
Text and Reference Books				
Textbook: 1. Introduction to the Design and Analysis of Algorithms, Levitin, A., Pearson, 2017.				
Reference Book: 1. Introduction to Algorithms, Cormen, T. H. Leiserson, C.E., Rivest, R.L.& Stein, C., MIT Press, 2019.				