



National University of Computer & Emerging Science

Department	Department of Computer Science	Dept. Code	CS
Course Title	Design and Analysis of Algorithms	Course Code	CS2009
Pre-requisite(s)	CS2001	Credit Hrs.	3

Course Objective:	Main objective of course is to understand required skills and knowledge to design and analyze algorithms. Students will learn several algorithm design techniques and use of mathematical tools for empirical analysis of algorithms. Additionally students will be able to learn effective problem solving skills in computing through this course.
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PLO	Program Learning Outcome (PLO) Statement
1	Computing Knowledge: Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
2	Problem Analysis: Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
9	Individual & Team Work Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	To apply acquired knowledge to solve computing problems complexities and proofs	Cognitive	C3	01	A1,Q1,M1,F
02	To analyze complexities of different algorithms using asymptotic notations, complexity classes and standard complexity function	Cognitive	C4	02	A2, Q2, M2
03	To evaluate generic algorithmic solutions such as sorting, searching and graphs applied to real-world problems	Cognitive	C5	05	A3, A4, Q3, M2, F
04	To construct and analyse real world problems solutions using different algorithms design techniques i.e. Brute Force, Divide and	Psychomotor	C6	09	Project



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	Conquer, Dynamic Programming, Greedy Algorithms.				
<i>Tool: A = Assignment, Q = Quiz, M = Midterm, F=Final, CEP = Complex Engineering Problem.</i>					

Text Book(s)	Title	Introduction to Algorithms” 2 nd Edition
	Author	Thomas H. Cormen et al.
	Publisher	MIT Press
Ref. Book(s)	Title	Introduction to the design and analysis of algorithms 3rd Edition.
	Author	Anany Levitin
	Publisher	Pearson

1. Topics to be covered:			
List of Topics	No. of Weeks	Contact Hours	CLO
Data Structures Review (Stack, Queue, Linked List, Hash Table, Binary Tree). Basics of Algorithms, Mathematical Foundation, Growth of Function, Asymptotic Notations. (Assignment 1 will be given at the end of week-1 and Project will be announced)	2	6	1
Divide and Conquer, Substitution Method, Recurrence-Tree Method, Master’s Method.	2	6	2
Sorting (Merge, Insertion, Quick, Heap, Counting, Radix, Bucket) (Assignment 2 will be given and Assignment 1 will be taken in 5 th week)	1	3	3
Dynamic Programming	1.5	4.5	3
Greedy Algorithms, Graph Theory (Graph Categorization, Graph Terminology, Representation of Graphs, BFS & DFS, Strongly Connected Components, Greedy Algorithms: Kruskal’s Algorithm, Prim’s	3	9	3



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Algorithms, Bellman-Ford Algorithms, Dijkstra's Algorithm) (Assignment 3 will be given and Assignment 2 will be taken in 8 th week)			
Geometric Algorithms (Introduction, Graham Scan, Close Points). String Matching (Assignment 4 will be given and Assignment 3 will be taken in 10 th week)	2	6	2,3
NP Complete Problems and Solutions using Approximation Algorithm, Amortized algorithms (Assignment 5 will be given and Assignment 4 will be taken in 13 th week)	2	6	1
Review	0.5	1.5	1,4
Project Presentations	1	3	4
Total	15	45	

Assessment Plan:

Assessment	Weightage
Quiz/Assignment	10
Midterm Exams	30 (15 each)
Project	10
Final	50