



# National University of Computer & Emerging Science

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

<b>Course Objective:</b>	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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<b>PLO</b>	<b>Program Learning Outcome (PLO) Statement</b>
1	<b>Computing Knowledge:</b> Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
2	<b>Problem Analysis:</b> Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
5	<b>Modern Tool Usage:</b> Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
9	<b>Individual &amp; Team Work</b> Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

<b>CLO</b>	<b>Course Learning Outcome (CLO)</b>	<b>Domain</b>	<b>Taxonomy Level</b>	<b>PLO</b>	<b>Tools</b>
01	To apply acquired knowledge to solve computing problems complexities and proofs	Cognitive	C3	01	A1, A2, A3, A4, A5, M1, M2, F
02	To analyze complexities of different algorithms using asymptotic notations, complexity classes and standard complexity function	Cognitive	C4	02	A1, A2, A3, A4, A5, M1, M2, F
03	To evaluate generic algorithmic solutions such as sorting, searching and graphs applied to real-world problems	Cognitive	C5	05	A3, A4, A5, M1, 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>					

<b>Text Book(s)</b>	<b>Title</b>	Introduction to Algorithms” 4 <sup>th</sup> Edition
	<b>Author</b>	Thomas H. Cormen et al.
	<b>Publisher</b>	MIT Press
<b>Ref. Book(s)</b>	<b>Title</b>	Introduction to the design and analysis of algorithms 3rd Edition.
	<b>Author</b>	Anany Levitin
	<b>Publisher</b>	Pearson

<b>1. Topics to be covered:</b>			
List of Topics	No. of Weeks	Contact Hours	CLO
Basics of Algorithms, Mathematical Foundation, Growth of Function, Asymptotic Notations.  (Assignment 1 will be given at the start of week-2 and Project will be announced)	<b>2</b>	<b>6</b>	<b>1</b>
Divide and Conquer, Substitution Method, Recurrence-Tree Method, Master’s Method.	<b>2</b>	<b>6</b>	<b>2</b>
Data Structures Review (Stack, Queue, Linked List, Hash Table, Binary Tree).  Sorting (Merge, Insertion, Quick, Heap, Counting, Radix, Bucket)  (Assignment 2 will be given)	<b>1</b>	<b>3</b>	<b>3</b>
Midterm1	<b>0.5</b>	<b>1</b>	<b>1,2,3</b>
Geometric Algorithms (Introduction, Graham Scan, Close Points). String Matching	<b>2</b>	<b>6</b>	<b>2,3</b>
Dynamic Programming (Assignment 3 will	<b>2</b>	<b>6</b>	<b>3</b>



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be given)			
Midterm2	0.5	2	1,2,3,4
Greedy Algorithms, Graph Theory (Graph Categorization, Graph Terminology, Representation of Graphs, BFS & DFS, Strongly Connected Components, Greedy Algorithms: Kruskal's Algorithm, Prim's Algorithms, Bellman-Ford Algorithms, Dijkstra's Algorithm)  (Assignment 4 will be given)	3	9	3
NP Complete Problems and Solutions using Approximation Algorithm, Amortized algorithms  (Assignment 5 will be given)	2	6	1
Project Presentations	1	3	4
Final	1	3	1,2,3,4
Total	17	51 (Including 3 hours final exam)	

## Assessment Plan:

Assessment	Weightage
Quiz/Assignment (Best 4 out of 5)	10
Midterm Exams	30 (Midterm1:12.5, Midterm2: 17.5)
Project	10
Final	50