Course Code	18CSC204J	Course Name	DESIGN AND ANALYSIS OF ALGORITHMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	18CSC201J, 18CSC202J	Co-requisite Courses	18CSC207J	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Design efficient algorithms in solving complex real time problems			
CLR-2 :	Analyze various algorithm design techniques to solve real time problems in polynomial time			
CLR-3 :	Utilize various approaches to solve greedy and dynamic algorithms			
CLR-4 :	Utilize back tracking and branch and bound paradigms to solve exponential time problems			
CLR-5 :	Analyze the need of approximation and randomization algorithms, utilize the importance Non polynomial algorithms			
CLR-6 :	Construct algorithms that are efficient in space and time complexities			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations	3	80	70
CLO-2 :	Solve problems using divide and conquer approaches	3	85	75
CLO-3 :	Apply greedy and dynamic programming types techniques to solve polynomial time problems.	3	75	70
CLO-4 :	Create exponential problems using backtracking and branch and bound approaches.	3	85	80
CLO-5 :	Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems	3	85	75
CLO-6 :	Create algorithms that are efficient in space and time complexities by using divide conquer, greedy, backtracking technique	3	80	70

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :	L	H	M	H	L	-	-	-	L	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction-Algorithm Design	Introduction-Divide and Conquer	Introduction-Greedy and Dynamic Programming	Introduction to backtracking - branch and bound	Introduction to randomization and approximation algorithm
	SLO-2	Fundamentals of Algorithms	Maximum Subarray Problem	Examples of problems that can be solved by using greedy and dynamic approach	N queen's problem - backtracking	Randomized hiring problem
S-2	SLO-1	Correctness of algorithm	Binary Search	Huffman coding using greedy approach	Sum of subsets using backtracking	Randomized quick sort
	SLO-2	Time complexity analysis	Complexity of binary search	Comparison of brute force and Huffman method of encoding	Complexity calculation of sum of subsets	Complexity analysis
S-3	SLO-1	Insertion sort-Line count, Operation count	Merge sort	Knapsack problem using greedy approach	Graph introduction	String matching algorithm
	SLO-2	Algorithm Design paradigms	Time complexity analysis	Complexity derivation of knapsack using greedy	Hamiltonian circuit - backtracking	Examples
S 4-5	SLO-1 / SLO-2	Lab 1: Simple Algorithm-Insertion sort	Lab 4: Quicksort, Binary search	Lab 7: Huffman coding, knapsack and using greedy	Lab 10: N queen's problem	Lab 13: Randomized quick sort
S-6	SLO-1	Designing an algorithm	Quick sort and its Time complexity analysis	Tree traversals	Branch and bound - Knapsack problem	Rabin Karp algorithm for string matching
	SLO-2	And its analysis-Best, Worst and Average case	Best case, Worst case, Average case analysis	Minimum spanning tree - greedy Kruskal's algorithm - greedy	Example and complexity calculation. Differentiate with dynamic and greedy	Example discussion
S-7	SLO-1	Asymptotic notations Based on growth functions.	Strassen's Matrix multiplication and its recurrence relation	Minimum spanning tree - Prims algorithm	Travelling salesman problem using branch and bound	Approximation algorithm
	SLO-2	O,Ω,Θ, ω, Ω	Time complexity analysis of Merge sort	Introduction to dynamic programming	Travelling salesman problem using branch and bound example	Vertex covering
S-8	SLO-1	Mathematical analysis	Largest sub-array sum	0/1 knapsack problem	Travelling salesman problem using branch and bound example	Introduction Complexity classes
	SLO-2	Induction, Recurrence relations	Time complexity analysis of Largest sub-array sum	Complexity calculation of knapsack problem	Time complexity calculation with an example	P type problems
S 9-10	SLO-1 / SLO-2	Lab 2: Bubble Sort	Lab 5: Strassen Matrix multiplication	Lab 8: Various tree traversals, Kruskal's MST	Lab 11: Travelling salesman problem	Lab 14: String matching algorithms
S-11	SLO-1	Solution of recurrence relations	Master Theorem Proof	Matrix chain multiplication using dynamic programming	Graph algorithms	Introduction to NP type problems
	SLO-2	Substitution method	Master theorem examples	Complexity of matrix chain multiplication	Depth first search and Breadth first search	Hamiltonian cycle problem
S-12	SLO-1	Solution of recurrence relations	Finding Maximum and Minimum in an array	Longest common subsequence using dynamic programming	Shortest path introduction	NP complete problem introduction
	SLO-2	Recursion tree	Time complexity analysis-Examples	Explanation of LCS with an example	Floyd-Warshall Introduction	Satisfiability problem
S-13	SLO-1	Solution of recurrence relations	Algorithm for finding closest pair problem	Optimal binary search tree (OBST)using dynamic programming	Floyd-Warshall with sample graph	NP hard problems
	SLO-2	Examples	Convex Hull problem	Explanation of OBST with an example.	Floyd-Warshall complexity	Examples
S 14-15	SLO-1 / SLO-2	Lab 3: Recurrence Type-Merge sort, Linear search	Lab 6: Finding Maximum and Minimum in an array, Convex Hull problem	Lab 9: Longest common subsequence	Lab 12: BFS and DFS implementation with array	Lab 15: Discussion over analyzing a real time problem

Learning Resources	
1.	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, 3rd ed., The MIT Press Cambridge, 2014
2.	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd ed., Pearson Education, 2005
3.	Ellis Horowitz, Sartajsahni, Sanguthevar, Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publication, 2010
4.	S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, 2015

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember / Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply / Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate / Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Cont. Paper etc.,

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