5 years Integrated M.Sc.(IT) [Semester 7th / 1st]

Lesson Planning

060010712/40250112 – Algorithm Analysis and Design – Theory

Objectives: To create analytical skills to design and analyze complexity of algorithms and build up solutions to real world problems.

Course Outcomes: Upon completion of the course, students shall be able to

CO1: Understand basic concepts of algorithms and to introduce mathematical aspects and analysis of algorithms.
CO2: Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO3: Apply the algorithms and design techniques to solve optimization problems.
CO4: Analyze the complexities of various problems in different domains.
CO5: Comprehend various fundamental text processing algorithms for quickly performing string searching and string matching

Unit	Unit Name	Sub Unit	Topics	No. of Lectures	Reference Chapter/Additional Reading	Teaching Methodology
1	Introduction	1.1	The Role of Algorithm in Computing	1	HSR#1, Page No 1-5 THC#1, Page No 5-11	Chalk and Talk
		1.2	Insertion Sort	1	HSR#3, Page No 151 GBP#4, Page No 107 TCH#2, Page No 16-22	Chalk and Talk
		1.3	Analysing algorithms	1	TCH#2, Page No 23-27	Chalk and Talk
		1.4	Designing algorithms	1	TCH#2, Page No 29-37	Chalk and Talk
		1.5	Asymptotic notations	1	HSR#1, Page No 29 GBP#3, Page No79-92 TCH#3, Page No 43-53	Chalk and Talk
		1.6	Recurrences	1	GBP#4 Page No 137 TCH#2, Page No 34 TCH#4, Page No 65-67,83-113	Chalk and Talk
2	Divide-and-Conquer	2.1	Binary Search	2	HSR#3, Page No 145-153	Video based
		2.2	Finding Maximum and Minimum	1	HSR#3, Page No 153-159	Chalk and Talk
		2.3	Merge Sort and Quick Sort	2	HSR#3, Page No 159-177	Chalk and Talk
		2.4	Matrix Multiplication	1		Chalk and Talk
		2.5	Exponential	1		Chalk and Talk
		2.6	Strassen's matrix multiplication	1	THC#4 Page No 75-83	Chalk and Talk
3.	Greedy Algorithm	3.1	General method	1	HSR#4, Page No 210-214	Chalk and Talk
		3.2	Optimal storage in tape	2	HSR#4, Page No 249-253	Chalk and Talk
		3.3	The knapsack problem	2	HSR#4, Page No 218-222	Chalk and Talk
		3.4	Minimum Cost spanning trees - Kruskal's and Prim's algorithm	1	HSR#4, Page No 236-244	Chalk and Talk
		3.5	Shortest paths - Dijkstra's algorithm	1	HSR#4, Page No 260-266 THC#24 Page No 658-664	Chalk and Talk

		3.6	Job scheduling problem	2	HSR#4, Page No 227-236	Chalk and Talk
4.	Dynamic Programming	4.1	Introduction: The Principle of Optimality, Calculating the Binomial Coefficient	1	HSR#5 Page No 273	Chalk and Talk
		4.2	Making Change Problem	1	http://interactivepython.org/runestone/static/pythonds/Recursion/DynamicProgramming.html https://www.youtube.com/watch?v=GafjS0FfAC0	Chalk and Talk
		4.3	The Knapsack Problem	2	HSR#5 Page No 305-312 https://www.youtube.com/watch?v=dN_gQYo9Uf8	Chalk and Talk
		4.4	Assembly Line Scheduling	1	AssemblyLineScheduling.doc https://www.youtube.com/watch?v=cmeSBpnmZPQ	Chalk and Talk
		4.5	Shortest paths	1	HSR#5 Page No 284-293	Chalk and Talk
		4.6	Chained matrix multiplication	1	THC#15, Page No 370-378	Chalk and Talk
		4.7	Longest Common Subsequence	1	HSR#5 Page No 331 https://www.youtube.com/watch?v=NnD96abizww	Chalk and Talk
5.	Graph Algorithms	5.1	Traversing Trees – Preconditioning	1	HSR#6, Page No 333-338	Chalk and Talk
		5.2	Depth First Search	1	THC#22, Page No 603-612 HSR#6, Page No 343-345	Chalk and Talk
		5.3	Breadth First Search	1	THC#22, Page No 594-602 HSR#6, Page No 340-343	Chalk and Talk
		5.4	Topological Sort	2	THC#22, Page No 612-615	Chalk and Talk
		5.5	Backtracking – The Knapsack Problem, The Eight queens problem	1	HSR#7, Page No 373-392	Chalk and Talk
		5.6	General Template	1		Chalk and Talk
6.	Branch & Bound and String Matching	6.1	Branch and Bound– Least Cost Search, 15 Puzzle Problem	2	HSR#8, Page No 399-406https://www.youtube.com/watch?v=tMwC2VSYSYs	Chalk and Talk
		6.2	Travelling salesman algorithm using branch & bound techniques	1	HSR#8, Page No 422-431 https://www.youtube.com/watch?v=nYCU5c1miUw&t=354s	Chalk and Talk
		6.3	String Matching - Introduction,	1	THC#32, Page No 985-987	Chalk and Talk
		6.4	The naive string matching algorithm	2	THC#32, Page No 988-990	Chalk and Talk
		6.5	The Rabin-Karp algorithm	1	THC#32, Page No 990-995	Chalk and Talk
		6.6	String Matching with finite automata	1	THC#32, Page No 995-1002	Chalk and Talk
Text Book:						

1. Horowitz, Sahni, Rajasekaran ,Fundamentals of Computer Algorithms: By, - Universities Press.**[HSR#]**

Reference Book:

2. Thomas H. Cormen et.al. , Introduction to Algorithms - PHI.**[THC#]**

3. Gills Brassard, Paul Bratley, Fundamental of Algorithms - PHI. **[GBP#]**

4. A V Aho and J. D. Ullman, Design and analysis of Algorithms - Pearson LPE.

5. Dave and Dave, Design and Analysis of Algorithms - Pearson.

Course Objectives and Course Outcomes Mapping:

To design and analyse an algorithm : CO1,CO2
Build up a solution to real word problem: CO3, CO4, and CO5.

Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcome				
		CO1	CO2	CO3	CO4	CO5
1	Introduction	✓				
2	Divide-and-Conquer		✓			
3	Greedy Algorithm			✓	✓	
4	Dynamic Programming			✓	✓	
5	Graph Algorithms			✓	✓	
6	Branch & Bound and String Matching					✓