Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE911	**Advanced Algorithms and Complexity(AAC)**	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		**MSE**	**ESE**			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		1. Data Structures 2. Discrete Structures 3. Introduction to Algorithms 4. Programming Languages A strong understanding of programming and a solid background in discrete mathematics, including probability, are necessary prerequisites to this course.
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Analyze worst-case running times of algorithms using asymptotic analysis
	CO2	Describe the divide-and-conquer paradigm and clarify when an algorithmic design situation calls for it.
	CO3	Describe the greedy paradigm and clarify when an algorithmic design situation calls for it
	CO4	Demonstrate a familiarity with applied algorithmic settings.
	CO5	Apply the concept of linear programming to optimize the solution
	CO6	Describe the idea of backtracking, branch and bound strategy to solve some problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
Foundations	1.1	The role of Algorithms in computing, Analyzing algorithms, Designing Algorithms	1,2	10
	1.2	Growth of Functions-Asymptotic notation, Mathematical Background for algorithm analysis	1,2	
	1.3	Recurrences, The substitution method, The recursion-tree method, The master method, Randomized algorithms, Linear time sorting	1,2	
Divide and Conquer Approach	1.4	Divide and Conquer Approach: Analysis of Merge sort, Analysis of Quick sort, Strassen, Fibonacci, Polynomial Multiplication	1,2	
Dynamic Programming	2.1	Assembly-line Scheduling, Matrix-chain multiplication, Elements of dynamic programming, Matrix-chain multiplication , Longest common subsequence	1,2	10
Greedy Algorithms	2.2	Elements of the greedy strategy, Huffman codes, Minimum Spanning Trees.	1	

Amortized Analysis	2.3	Aggregate analysis, The accounting method, Table Doubling, The potential method	1	
Graph Algorithms	3.1	Single-Source Shortest Paths-The Bellman-Ford algorithm, Dijkstra's algorithm, Difference constraints and shortest paths All-Pairs Shortest Paths-The Floyd-Warshall algorithm Maximum Flow-Flow networks, The Ford-Fulkerson method, Maximum bipartite matching, Red Black Tree	1,2	10
NP Completeness	3.2	NP-Completeness: NP-completeness and reducibility, NP-completeness proofs, NP-complete problems,	1,4	
Approximation Algorithms	4.1	Approximation algorithms: The vertex-cover problem, The traveling-salesman problem, The set covering problem, The subset-sum problem	1,2	6
Applied Algorithms	4.2	Number-Theoretic : Number Theoretic notion, Greatest common divisor, The Chinese remainder theorem, RSA String Matching Algorithms :The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm, Probabilistic Algorithm: Game Theoretic Techniques Randomized Algorithms: Monte Corlo and Las Vegas algorithm	1,3	8
Linear Programming	5.2	Standard and Slack Forms, Formulation, Simplex algorithm, Duality	1,2	8
Advance topic	5.3	Parallel Algorithms, Dynamics Multithreading, Greedy Scheduler, Multithreaded Algorithms, cache oblivious algorithm	1,2,3	
			Total	**52**

In-Semester Examination (ISE): The assessment includes the submission of a term paper by each student on the contemporary work related to Advanced Algorithms and Complexity.

References:

[1] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", PHI, India Second Edition

[2] Horowitz, Sahani and Rajsekaran, Fundamentals of Computer Algorithms", Galgotia

[3] Rajeev Motwani, PrabhakarRaghavan, " Randomized Algorithm", Cambridge University Press

[4] Aho, Hopcroft, Ullman: The Design and analysis of algorithms", Pearson Education 2. Vijay V. Vajirani, "Approximation Algorithms",Spring