



DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE & Affiliated to Anna University, Chennai)

Re-Accredited by NAAC with 'A' Grade

Accredited by NBA for AERO, BME, CSE, ECE, EEE, IT & MECH.

PERAMBALUR-621212, TAMILNADU, INDIA.

Website: www.dsengg.ac.in



COURSE PLAN (2024-2025 EVEN SEMESTERS)

Name of the Faculty				
Designation/Department	ASSISTANT PROFESSOR/IT			
Course Code/Name	U23ITT41/ DESIGN AND ANALYSIS OF ALGORITHMS			
Year/Section/Department	II / IT A,B C			
Credits Details	L: 3	T: 0	P: 0	C: 4
Total Contact Hours Required	60			

Syllabus:

UNIT I/ INTRODUCTION	12
Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naive string- matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort.	
UNIT II/ GRAPH ALGORITHMS	12
Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm, Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.	
UNIT III/ ALGORITHM DESIGN TECHNIQUES	12
Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem – Optimal Merge pattern — Huffman Trees.	
UNIT IV/ STATE SPACE SEARCH ALGORITHMS	12
Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem - Travelling Salesman Problem.	
UNIT V/ NP-COMPLETE AND APPROXIMATION ALGORITHM	12
Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP-3 - CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding kth smallest number.	

Periods: 60

Course objective:

- To understand and apply the algorithm analysis techniques on searching and sorting algorithms.
- To critically analyze the efficiency of graph algorithms.
- To understand different algorithm design techniques.
- To solve programming problems using state space tree.
- To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms

Text Book:

- T1.** T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, "Introduction to Algorithms", Third Edition, Prentice Hall of India Pvt. Ltd, 2009.
- T2.** Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008.

Reference Book:

- R1.** Anany Levitin, —Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education, 2012.
- R2.** Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, Reprint 2006.
- R3.** S. Sridhar, —Design and Analysis of Algorithms, Oxford university press, 2014.

Website:

- W1.** https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
- W2.** <https://www.javapoint.com/daa-tutorial>.

Online Mode of Study (if Any):

- NPTEL :**
- ❖ <https://www.youtube.com/watch?v=J-Ny5qlW4F4>
 - ❖ <https://www.youtube.com/watch?v=xq3Lqp4QHUA>

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I INTRODUCTION						
(12)						
1.	Algorithm analysis: Time and space complexity.	T1	3-7	BB	1	1
2.	Asymptotic Notations and its properties Best case, Worst case and average case analysis.	T1	9-16	BB	1	2
3.	Recurrence relation: substitution method.	T1, T2	18-23	BB	1	3
4.	Lower bounds.	T1, T2	41-50	BB	1	4
5.	searching: linear search, binary search	T1	84-90	BB	1	5
6.	Interpolation Search.	T1	52-59	BB	1	6
7.	Pattern search	T1	61-70	BB	1	7
8.	The naive string- matching algorithm	T1, T2	61-70	BB	1	8
9.	Rabin-Karp algorithm	T1	70-76	BB	1	9
10.	Knuth-Morris-Pratt algorithm	T1	71-76	BB	1	10
11.	Sorting: Insertion sort – heap sort	T1	76-80	BB	2	12
Outcome of Unit I:						
At the end of unit, the students will be able to:						
CO1: Discuss the fundamental concepts problem solving algorithm, its types and the parameters to Analyze those algorithms.						
UNIT II GRAPH ALGORITHMS						
(12)						
12.	Graph algorithms: Representations of graphs	T1	97-106	BB	1	13
13.	Graph traversal: DFS – BFS	T2	108-113	BB	2	15
14.	strong connectivity, bi-connectivity	T2	115-117	BB	1	16
15.	Minimum spanning tree: Kruskal's and Prim's algorithm.	T1	117-118	BB	2	18
16.	Shortest path: Bellman-Ford algorithm -	T1	119-120	BB	1	19
17.	Dijkstra's algorithm - Floyd-Warshall algorithm,	T1	150-151 169-174	BB	2	21
18.	Flow networks - Ford-Fulkerson method.	T2	176-181	BB	2	23

19.	Matching: Maximum bipartite matching	T1	186-189	BB	1	24
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Outcome of Unit II:

At the end of unit , the students will be able to:

CO2: Explain the basic concept of Graph algorithms and its usages.

UNIT III ALGORITHM DESIGN TECHNIQUES**(12)**

20.	Divide and Conquer methodology: Finding maximum and minimum	T3	283-290	BB	1	25
21.	Merge sort - Quick sort.	T3	304-311	BB	2	27
22.	Dynamic programming: Elements of dynamic. programming	T3	258-264	BB	1	28
23.	Matrix-chain multiplication.	T2, R1	297-302	BB	1	29
24.	Dynamic Programming: General Method	T2, R2	292-296	BB	1	30
25.	Multistage Graphs	R2	197-198	PPT	2	32
26.	Optimal binary search trees.	T3	318-327	BB	1	33
27.	Greedy Technique: Elements of the greedy strategy - Activity- selection problem	T3	318-327	BB	1	34
28.	Optimal Merge pattern - Huffman Trees.	T3	318-327	BB	2	36

Outcome of Unit III:

At the end of unit , the students will be able to:

CO3: Explain the dynamic programming and greedy techniques to solve computing problems.

UNIT IV STATE SPACE SEARCH ALGORITHMS**(12)**

29.	Backtracking: n-Queens problem	T1,R1	345-358	BB	2	38
30.	Hamiltonian Circuit Problem	T3,R1	345-358	BB	2	40
31.	Graph colouring problem.	T3,R1	362-367	BB	2	42
32.	Branch and Bound: Solving 15Puzzle problem	T3,R1	368-374	BB	1	43
33.	Assignment problem.	T4	161-170	PPT	2	45
34.	Knapsack Problem	T1,R1	361-370	PPT	1	46
35.	Travelling Salesman Problem.	T1,R3	372-378	BB	2	48

Outcome of Unit IV:

At the end of unit , the students will be able to:

CO4: Describe how scientific problems can be solved using State Space Search algorithms and how to cope with Limitations of algorithm power.

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM**(12)**

36.	Tractable and intractable problems: Polynomial time algorithms	T2,R4	388-409	BB	1	49
37.	Venn diagram representation	T2,R4	424-427	BB	1	50

38.	NP-algorithms - NP-hardness and NP-completeness.	R1	427-430	BB	1	51
39.	Bin Packing problem.	T1	424-427	BB	2	53
40.	Problem reduction: TSP-3 – CNF.	T1	432-436	BB	2	55
41.	Approximation Algorithms: TSP.	R2	436-438	BB	2	57
42.	Randomized Algorithms: concept and application	T4,W1	438-440	BB	1	58
43.	randomized quick sort	T4,T2	441-443	PPT	1	59
44.	Finding kth smallest number.	T4,T2	443-457	BB	1	60

Outcome of Unit V:

At the end of unit, the students will be able to:

CO5: Compare & analyze the different algorithm design techniques for a given problem based on its

Time and space complexity.

CO6: Build existing algorithms to improve efficiency.

Course Outcome:

At the end of the course, the student should be able to

CO1: Discuss the fundamental concepts problem solving algorithm, its types and the parameters to analyze those algorithms (K2)

CO2: Explain the basic concept of Graph algorithms and its usages.(K2)

CO3: Explain the dynamic programming and greedy techniques to solve computing problems.(K2)

CO4: Describe how scientific problems can be solved using State Space Search algorithms and how to cope with limitations of algorithm power.(K2)

CO5: Compare and analyze the different algorithm design techniques for a given problem based on its time and space complexity.(K3)

CO6: Build existing algorithms to improve efficiency (K3)

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	2
CO6	2	2	1	1	-	-	-	-	-	-	-	-	2	2
AVG	2.33	1.33	1.00	1.00	-	-	-	-	-	-	-	-	2.00	2.00

Content beyond Syllabus:

❖ Stable marriage problem.

ASSIGNMENT:

Web Portal	Assignment	Components	Topic Number with Topic/Unit Details	
Web Portal 1			2) Asymptotic Notations and its properties Best case, Worst case and average case analysis. 9) Rabin-Karp algorithm.	
			15) Minimum spanning tree: Kruskal's and Prim's algorithm.	
Web Portal 2		Seminar(20)	20) Merge sort - Quick sort. 32) Assignment problem.	
		Case Study Report (20)	39) NP-algorithms - NP-hardness and NP-completeness. 30) Finding kth smallest number.	
Web Portal 3				

Submission Details:

Phase 1(Before AT 1)	Phase 2 (Before AT 2)	Phase 3 (Before MODEL)
Assignment 1 & 2	Assignment 3 & 4	Assignment 5

Google class name: U20IT303_DAA_CLASSROOM

Google class code:

Prepared By

Verified By

HOD/IT

Approved By

PRINCIPAL.