



COURSE PLAN

Course Code/Name	U23AIT34/ DESIGN AND ANALYSIS OF ALGORITHMS			
Year/Section/Department	II/A/AI&DS			
Credits Details	L: 3	T: 0	P: 0	C: 4
Total Contact Hours Required	60			

Syllabus:

UNIT I/ FUNDAMENTALS OF ALGORITHM ANALYSIS	No. Of Periods: 12
Introduction - Problem solving techniques-Analysis framework – Time space tradeoff – Asymptotic notations – Conditional asymptotic notation – Properties of Big-Oh notation – Recurrence equations – Mathematical Analysis of Non-recursive algorithms - Mathematical analysis of recursive Algorithms – Analysis of linear search - Empirical analysis - Algorithm visualization.	
UNIT II/ BRUTE FORCE AND DIVIDE AND CONQUER STRATEGIES	No. Of Periods: 12
Brute Force: Selection Sort - Bubble Sort – String matching - Exhaustive Search: Travelling Salesman problem - Divide and Conquer: General Method – Binary Search – Closest-pair problem – Merge Sort-Quick Sort	
UNIT III/ GREEDY AND DYNAMIC PROGRAMMING PARADIGMS	No. Of Periods: 12
Greedy Algorithms: General Method – Container Loading – Huffman code – Knapsack problem - Dynamic Programming: General Method – Multistage Graphs – Optimal binary search trees.	
UNIT IV/ BACKTRACKING AND TRANSFORM AND CONQUER METHODOLOGIES	No. Of Periods: 12
Backtracking: General Method – N-Queen’s problem – Sum of subsets – Graph coloring – Hamiltonian problem. Transform and conquer: Presorting – Gaussian elimination.	
UNIT V/ GRAPH, BRANCH AND BOUND STRATEGIES	No. Of Periods: 12
Graph: Connected Components – Bi-connected components – Branch and Bound: General Method (FIFO and LC) – Job assignment problem - 0/1 Knapsack problem – Introduction to NP-Hard and NP-Completeness.	

Objective:

- ❖ Analyze the algorithms that are used to solve various problems.
- ❖ Generate and solve the recurrences for divide and conquer techniques.
- ❖ Solve the problems using greedy and dynamic programming paradigms.
- ❖ Design the algorithms for solving the backtracking and transform and conquer methodologies.
- ❖ Apply the branch and bound technique to solve various problems.

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. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education, 1999.
- T3. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008.
- T4. K.S. Easwarakumar, “ Object Oriented Data Structures Using C++”, Vikas Publication House Pvt Ltd, First Edition, 2000.

Website:

- W1: https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
- W2: https://www.javatpoint.com/design_and_analysis_of_algorithms/index.htm

Online Mode of Study:

- NPTEL <https://www.youtube.com/watch?v=BAUjhHmjgy4>
- ❖ <https://www.youtube.com/watch?v=J-Ny5qIW4F4>
 - ❖ <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 1-FUNDAMENTALS OF ALGORITHM ANALYSIS						
1	Introduction, Algorithm, Notion of algorithm	T1	3-7	BB	1	1
2	Introduction - Problem solving techniques	T1	9-16	BB	1	2
3	Analysis framework - Time space tradeoff - Asymptotic notations	T1, T2	18-23	BB	1	3
4	Conditional asymptotic notation - Properties of Big-Oh notation	T1, T2	41-50	BB	3	6
5	Analysis of linear search- Empirical analysis.	T1	84-90	BB	1	7
6	Recurrence equations	T1	52-59	BB	1	8
7	Mathematical analysis for non-recursive algorithms - General plan for analyzing time efficiency	T1	61-70	BB	2	10
8	Analysis of linear search Empirical analysis	T1, T2	61-70	BB	1	11
9	Algorithm visualization.	T1, T2	70-76	BB	1	12
Outcome of Unit I:						
CO1: Discuss the fundamental concepts problem solving algorithm, its types and the parameters to Analyze those algorithms.						
CO2: Explain the basic recurrence equations Techniques.						
UNIT II - BRUTE FORCE AND DIVIDE AND CONQUER STRATEGIE						
10.	Brute Force: Selection Sort	T1	97-106	BB	1	13
11.	Bubble Sort	T2	108-113	BB	1	14
12.	Exhaustive Search - Travelling Salesman Problem	T2	115-117	BB	1	15

13.	Divide and conquer General Method	T1	117-118	BB	1	16
14.	Merge Sort	T1	119-120	BB	2	18
15.	Quick Sort	T1	150- 151 169-174	BB	2	20
16.	String matching	T2,W1	176- 181 226-232	BB	1	21
17.	Binary Search	T1	186-189	BB	2	23
18.	Closest-pair problem	T1,W1	192-197	BB	1	24

Outcome of Unit II:

CO3: Explain the Brute Force method and Divide and Conquer method to solve computing problems.

CO4: Analysis the sorting and search methods.

UNIT III - GREEDY AND DYNAMIC PROGRAMMING PARADIGMS

19.	Greedy Algorithms: General Method	T3	283-290	BB	1	25
20.	Container Loading	T3	304-311	BB	1	26
21.	Huffman code	T3	258-264	BB	2	28
22.	Knapsack problem	T2, R1	297-302	BB	2	30
23.	Dynamic programming: General Method	T2, R2	292-296	BB	1	31
24.	Multistage Graphs –	R2	197-198	BB	2	33
25.	Optimal binary search trees.	T3	318-327	BB	1	34
26.	Optimal binary search trees	T3	318-327	BB	1	35
27.	Optimal binary search trees	T3	318-327	BB	1	36

Outcome of Unit III:

CO3: Compare the multistage graphs and optimal binary search trees.

UNIT IV - BACKTRACKING AND TRANSFORM AND CONQUER METHODOLOGIES

28.	Backtracking: General Method	T1,R1	345-358	BB	1	37
29.	N-Queen's problem	T3,R1	345-358	BB	2	39
30.	Sum of subsets	T3,R1	362-367	BB	2	41

31.	Graph coloring	T3,R1	368-374	BB	1	42
32.	Hamiltonian problem	T4	161-170	BB	2	44
33.	Transform and conquer : Presorting	T1,R1	361-370	BB	1	45
34.	Gaussian elimination.	T1,R3	372-378	BB	1	46
35.	Gaussian elimination.	T1,R3	372-378	BB	1	47

Outcome of Unit IV:

C04: Describe how scientific problems can be solved using iterative method and how to cope with Limitations of algorithm power.

UNIT V - GRAPH, BRANCH AND BOUND STRATEGIES

36.	Graph: Connected Components	T2,R4	388-409	BB	1	48
37.	Bi-connected components	T2,R4	424-427	BB	1	49
38.	Branch and Bound: General Method (FIFO and LC)	R1	427-430	BB	3	52
39.	Job assignment problem	T1	424-427	BB	3	55
40.	0/1 Knapsack problem	T1	432-436	BB	2	57
41.	Introduction to NP	R2	436-438	BB	1	58
42.	Hard and NP-	T4,W1	438-440	BB	1	59
43.	Completeness	T4,T2	441-443	BB	1	60

Outcome of Unit V:

C05: Compare & analyze the different algorithm design techniques for a given problem based on its Time and space complexity.

C06: Build existing algorithms to improve efficiency

Course Outcome:

At the end of course: Students should be able to do:

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

CO2: Explain the Brute Force method and Divide and Conquer method to solve computing problems. (K2)

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

CO4: Describe how scientific problems can be solved using iterative method 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:

COs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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:

- ❖ Horse Solving problem in Backtracking Method
- ❖ SudoKo Solving Problem.

Internal Evaluation Components:

Webportal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
	--	Assessment - I (60)	Unit I and II	CO 1 & CO2
Webportal 1	1	Assignment - Handwritten (20)	1.Fundamentals of the Analysis of Algorithmic Efficiency 2.Asymptotic Notations and their properties. 3.Analysis of linear search.	
	2	Assignment - Poster Presentation / PPT (20)	1.Selection sort. 2.Bubble sort. 3.Exhaustive search.	
	--	Assessment - II (60)		CO3 & CO4
Webportal 2	3	Seminar (20)	1.Dynamic programming. 2.Multistage Graphs. 3.Optimal binary search trees	
	4	Case Study Report (20)	1.N-Queen's problem 2.0/1 Knapsack problem 3.Graph coloring	
	--	Model Exam (75)		CO1 to CO6
Webportal 3	5	MCQ (15)	1.Mathematical Analysis of Non-recursive & recursive algorithm 2.Binary Search 3.Dynamic Programming 4.Transform and conquer 5.NP-Hard and NP-Completeness	CO1 to CO6
	-	Course Attendance (10)	Attendance Percentage >=75% = 2 Mark >=80% = 4 Mark >=85% = 6 Mark >=90% = 8 Mark >=95% = 10 Mark	--

Submission Details:

Phase 1(Before AT 1)		Phase 2 (Before AT 2)		Phase 3 (Model)
Assignment 1	Assignment 2	Assignment 3	Assignment 4	Assignment 5

Google Class Code Details:

Class Name:

PLAN OF ASSESSMENT TEST -DISTRIBUTION OF MARKS:

TEST	CO- MARK WISE DISTRIBUTION						BLOOM'S LEVEL MARK WISE DISTRIBUTION					
	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
AT-1												
AT-2												
MODEL												

Prepared By

Verified By

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