Department of Information Technology	**LP: IT18401** **Rev. No: 00** **Date: 14.12.2019**
B.E/B.Tech **Regulation: 2018** **Sub. Code / Sub. Name : IT18401 / Paradigms of Algorithm Design** **Unit : I**	

Unit Syllabus:

FUNDAMENTALS

Algorithms - The Importance of Developing Efficient Algorithms - Analysis of Algorithms Order - Computational Complexity-sorting , searching, hashing, selection problem

Objective: To understand existing algorithms for simple computational problems, to write algorithms as pseudo-code for sorting and searching problems and compute their time complexity

Session No *	Topics to be covered	Ref	Teaching Aids
1	Algorithms, Different ways of writing algorithms - Merits and Demerits, The Importance of Developing Efficient Algorithms-Goals	1-Ch.1 P.no (12-18)	LCD/BB
2	Writing simple algorithms – Maximum of 3 numbers, Factorial, gcd of 2 numbers, Sum of first n natural numbers	1-Ch.1 P.no (12-18)	LCD/BB
3	Writing simple algorithms – Sequential search, Adding Array elements, Exchange sort, Matrix multiplication.	1-Ch.1 P.no (12-18)	LCD/BB
4	Recursive algorithms and Analysis of Recursive algorithms - Sequential Vs Binary Search	1-Ch.1 P.no (19-20)	LCD/BB
5	Recursive Vs Iterative method for generating fibonacci series	1-Ch.1 P.no (21-25)	LCD/BB
6	Analysis of Algorithms – Complexity Analysis, Analysis of correctness	1-Ch.1 P.no (26-45)	LCD/BB
7	Determining time complexity for Sequential search, Adding Array elements, Exchange sort, Matrix multiplication	1-Ch.1 P.no (26-45)	LCD/BB
8	Order of growth, Asymptotic Notations - types, Order of complexity-properties	1-Ch.1 P.no (26-45) 2-ch.3 pg.no(39-48)	LCD/BB
9	Solving Recurrence relation	1-Ch.1 P.no (26-45) 2-ch.4 pg.no 59-73	
Content Beyond Syllabus : Recursive algorithms and Analysis of Recursive algorithms			

* Session duration: 50 minutes

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Unit : II

Unit Syllabus :

ALGORITHM STRATEGY:

Divide-and-Conquer - Sorting -Searching- Strassen's Matrix Multiplication Algorithm Arithmetic with Large Integers. Dynamic Programming - Binomial co-efficient - Floyd's Algorithm for Shortest Paths - Chained Matrix Multiplication - Dynamic Programming and Optimization Problems- Optimal Binary Search Trees - The Traveling Salesperson Problem

Objective: To learn Divide and Conquer and Dynamic Programming strategies and apply them to solve computational problems.

Session No *	Topics to be covered	Ref	Teaching Aids
9	Divide-and-Conquer – General Strategy, Sorting -Merge Sort	1 ch:2 pg.no: 50-60	LCD/BB
10	Quick Sort	1 ch:2 pg.no:62-68	LCD/BB
11	Searching - Binary Search, Strassen's Matrix Multiplication	1 ch:2 pg.no:68-72	LCD/BB
12	Arithmetic with Large Integers – Large Integer Addition and Multiplication	1 ch:2 pg.no:74-80	LCD/BB
13	Dynamic Programming **-** General Strategy, Fibonacci Series, Binomial co-efficient	1 ch:3 pg.no:89-103	LCD/BB
14	DP and Optimization Problems - All Pair Shortest Path Problem - Floyd's Algorithm for Shortest Paths	1 ch:3 pg.no:89-103	LCD/BB
15	Chained Matrix Multiplication	1 ch:3 pg.no:104-112	LCD/BB
16	Longest Common Subsequence (LCS) Problem	1 ch:3 pg.no: 104-112	LCD/BB
17	Optimal Binary Search Trees	1 ch:3 pg.no:113-122	LCD/BB
18	The Traveling Salesperson Problem	1 ch:3 pg.no:122-140	LCD/BB

Content beyond syllabus covered (if any): Longest Common Subsequence (LCS) Problem.

- Session duration: 50 mins

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Unit : III

Unit Syllabus :

DESIGN TECHNIQUES

Greedy Approach - Minimum Spanning Trees-scheduling - The Greedy Approach versus Dynamic Programming: The Knapsack Problem – Backtracking - Using a Monte Carlo Algorithm - The Sumof-Subsets Problem - Graph Coloring - The Hamiltonian Circuits Problem - Branch-and-Bound - Best-First Search

Objective: To learn Greedy, Backtracking and Branch & Bound techniques and apply them to solve computational problems.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Greedy Approach – General Strategy, Change Making problem	**1 ch:4 pg.no:131-161 2 ch:16 317-330**	**LCD/BB**
20	Minimum Spanning Trees – Prims and Kruskal Algorithms	**1 ch:4 pg.no:131-161**	**LCD/BB**
21	Scheduling-Minimizing total time in Systems, Scheduling with Deadline	**1 ch:4 pg.no:131-161**	**LCD/BB**
22	The Greedy Approach versus Dynamic Programming: The Knapsack Problem	**1 ch:4 pg.no:131-161**	**LCD/BB**
23	Backtracking - General Strategy, N Queen Problem	**1 ch:5 pg.no:190-206**	**LCD/BB**
24	Using a Monte Carlo Algorithm to estimate Backtracking algorithm efficiency	**1 ch:5 pg.no:190-206**	**LCD/BB**
25	The Sum-of-Subsets Problem ,Graph Coloring Problem	**1 ch:5 pg.no:190-206**	**LCD/BB**
26	Hamiltonian Circuit Problem	**1 ch:5 pg.no:190-206**	**LCD/BB**
27	Branch & Bound technique – General Strategy, Best-First Search	**1 ch:6 pg.no:218-229**	**LCD/BB**

Content beyond syllabus covered (if any): N Queen Problem

- Session duration: 50 mins

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Unit : IV

Unit Syllabus :

NP COMPLETENESS
NP-completeness – Polynomial Time - Polynomial Time Verification - Reducibility - NPcompleteness proofs - Approximation Algorithms - Vertex-Cover problem – Travelling-Salesman problem

Objective: To understand the difference between Polynomial and Non-Deterministic Polynomial algorithms. To get exposed to NP Complete problems

Session No *	Topics to be covered	Ref	Teaching Aids
28	Classes of algorithms – Polynomial, NP, NP Complete, NP-Hard	**1Ch:9,pg.no:346-366**	**LCD/BB**
29	NP Completeness, Polynomial Time	**1Ch:9,pg.no:346-366**	**LCD/BB**
30	Polynomial Time Verification	**1Ch:9,pg.no:346-366**	**LCD/BB**
31	Reducibility	**1Ch:9,pg.no:346-366**	**LCD/BB**
32	NPcompleteness proofs	**1Ch:9,pg.no:346-366**	**LCD/BB**
33	NPcomplete Problems	**1Ch:9,pg.no:346-366**	**LCD/BB**
34	Approximation Algorithms – Introduction	**1Ch:9,pg.no:370-378**	**LCD/BB**
35	Vertex Cover Problem	**1Ch:9,pg.no:370-378**	**LCD/BB**
36	Travelling-Salesman problem	**1Ch:9,pg.no:370-378**	**LCD/BB**

Content beyond syllabus covered (if any): NPcomplete Problems

- Session duration: 50 mins

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Unit : V

Unit Syllabus:

PARALLEL ALGORITHMS AND GENETIC ALGORITHMS

Parallel Architectures - The PRAM Model - Designing Algorithms for the CREW PRAM Model - Designing Algorithms for the CRCW PRAM Model

Objective: To understand Parallel Architectures and design parallel algorithms.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Parallel Architectures- Control mechanism, address space organisation, inter connection networks	**1,ch:11(Pg.no434-445)**	**LCD/BB**
38	The PRAM Model	**1,ch:11(Pg.no444-446)**	**LCD/BB**
39	Designing Algorithms for the CREW PRAM Model -Finding largest key	**1,ch:11(Pg.no446-453)**	**LCD/BB**
40	Designing Algorithms for the CREW PRAM Model - Binomial co.efficient	**1,ch:11(Pg.no446-453)**	**LCD/BB**
41	Designing Algorithms for the CREW PRAM Model -Merge sort	**1,ch:11(Pg.no446-453)**	**LCD/BB**
43	**Analysis of CREW PRAM Model**	**1,ch:11(Pg.no446-453)**	**LCD/BB**
44	Designing Algorithms for the CRCW PRAM Model - Finding largest key Finding largest key	**1,ch:11(Pg.no454-456)**	**LCD/BB**
45	**Analysis of CRCW PRAM Model**	**1,ch:11(Pg.no454-456)**	**LCD/BB**
Content beyond syllabus covered (if any): Analysis of CREW PRAM Model, Analysis of CRCW PRAM Model			

* Session duration: 50 mins

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TEXTBOOKS

1. Foundations of Algorithms,Richard E Neapolitan, 5th Edition,Jones & Bartlett Learning,2014.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms“, PHI Learning Private Limited, 2012.

REFERENCES

1. S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, First Edition, 2015.
2. Steven S Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2010.
3. Robert Sedgewick and Kevin Wayne, ―Algorithms‖, Fourth Edition, Pearson Education, 2011.

	Prepared by	Approved by
Signature	N.Devi	
Name	**Dr.V.Vidhya** Ms..N.Devi	Dr.V.Vidhya
Designation	Prof/IT , AP/IT	HoD/INT
Date	**14.12.2019**	**14.12.2019**
Remarks *:		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD