DESIGN AND ANALYSIS OF ALGORITHMS

IV Semester: CSE/IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB05	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

Students will try to Learn:

I. Mathematical approach for Analysis of Algorithms.
II. Methods and techniques foranalyzing the correctness and resource requirements of algorithms.
III. Different paradigms of algorithm design including recursive algorithms, divide-and-conquer algorithms, dynamic programming, greedy algorithms, Backtracking, Branch and Bound and graph algorithms.
IV. Strategies for solving problems not solvable in polynomial time.

COURSE OUTCOMES:

After Successful completion of this course, students will be able to:

CO 1 Find the (worst case, randomized, amortized) running time and space complexity of given algorithms using techniques such as loop summations, recurrences, charging arguments and properties of probability

CO 2 Apply divide and conquer algorithms for solving sorting, searching and matrix multiplication problems.

CO 3 Make Use ofappropriate tree traversal techniques for solving graph problems.

CO 4 Compare the efficiencies of same problem using different algorithms (e.g. searching, sorting and graph traversal)

CO 5 Applygreedy algorithms for finding solutions of minimization and maximization problems.

CO 6 Analyse dynamic programing algorithms for calculating optimised solution of the problem.

CO 7 Utilize backtracking and branch and bound techniquesto deal with traceable and in -traceable problems.

CO 8 Describe the classes P, NP, NP-Hard , NP-complete for solving deterministic and non-deterministic problems

CO 9 Develop efficient algorithms for common computer engineering design problems.

CO 10 Apply the knowledge and skills for employability and to succeed in national and international level competitive exams.

MODULE-I INTRODUCTION

Algorithm: Pseudo code for expressing algorithms; Performance analysis: Space complexity, time complexity; Asymptotic notations: Big O notation, omega notation, theta notation and little o notation, amortized complexity; Divide and Conquer: General method, binary search, quick sort, merge sort, Strassen's matrix multiplication.

MODULE-II	SEARCHING AND TRAVERSAL TECHNIQUES
Disjoint set operations, union and find algorithms; Efficient non recursive binary tree traversal algorithms, spanning trees; Graph traversals: Breadth first search, depth first search, connected components, bi-connected components.	
MODULE-III	**GREEDY METHOD AND DYNAMIC PROGRAMMING**
Greedy method: The general method, job sequencing with deadlines, knapsack problem, minimum cost spanning trees, single source shortest paths. Dynamic programming: The general method, matrix chain multiplication optimal binary search trees, 0/1 knapsack problem, single source shortest paths, all pairs shortest paths problem, the travelling salesperson problem.	
MODULE-IV	**BACKTRACKING AND BRANCH AND BOUND**
Backtracking: The general method, the 8 queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles; Branch and bound: The general method, 0/1 knapsack problem, least cost branch and bound solution, first in first out branch and bound solution, travelling salesperson problem.	
MODULE-V	**NP-HARD AND NP-COMPLETE PROBLEM**
Basic concepts: Non-deterministic algorithms, the classes NP - Hard and NP, NP Hard problems, clique decision problem, chromatic number decision problem, Cook's theorem.	

Text Books:

1. Ellis Horowitz, SatrajSahni, SanguthevarRajasekharan, ―Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, ―The Design And Analysis Of Computer Algorithms, Pearson India, 1st Edition, 2013.

Reference Books:

1. Levitin A, ―Introduction to the Design and Analysis of Algorithms‖, Pearson Education, 3rd Edition, 2012.
2. Goodrich, M. T. R Tamassia, ―Algorithm Design Foundations Analysis and Internet Examples‖, John Wileyn and Sons, 1st Edition, 2001.
3. Base Sara Allen Vangelder, ―Computer Algorithms Introduction to Design and Analysis‖, Pearson, 3rd Edition, 1999.

Web References:

1. http://www.web.stanford.edu/class
2. http://www.saylor.org/course
3. http://www.cse.iitd.ernet.in/~bagchi/courses/design&analysis-book