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	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of algorithm as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

II. OBJECTIVES:

The course should enable the students to:

I Calculate performance of algorithms with respect to time and space complexity.

II Illustrate the graph traversals and tree traversals to solve the problems

III Demonstrate the concepts greedy method and dynamic programming for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP.

IV Illustrating the methods of backtracking and branch bound techniques to solve theproblems like n-queens problem, graph coloring and TSP respectively

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Find** the (worst case, randomized, amortized) running time and spacecomplexity of given algorithms using techniques such as recurrences and properties of probability.	Remember
CO 2	**Apply** divide and conquer algorithms for solving sorting, searching and matrix multiplication.	Apply
CO 3	**Make Use of** appropriate tree traversal techniques for findingshortest path.	Apply
CO 4	**Identify** suitable problem solving techniques for a given problem and finding optimized solutions using Greedy and Dynamic Programming techniques	Remember
CO 5	**Utilize** backtracking and branch and bound techniques to deal withtraceable and in-traceable problems.	Apply
CO 6	**Describe** the classes P, NP, NP-Hard, NP-complete for solvingdeterministic and non deterministic problems.	Understand

IV. SYLLABUS:

MODULE -I	INTRODUCTION	Classes: 09

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	Classes: 08

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, biconnected components.

MODULE -III	GREEDY METHOD AND DYNAMIC PROGRAMMING	Classes: 10

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	Classes: 09

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 PROBLEMS	Classes:09

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, Satraj Sahni, Sanguthevar Rajasekharan, ―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.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

E-Text Books:

1.http://ebook/com/item/introduction_to_the_design_and_analysis_of_algorithms_3rd_editionananylevitin/
2. https://drive.google.com/file/d/0B_Y1VbyboEDBTDVxVXpVbnk4TVE/edit?pref=2&pli=1
3. http://www.amazon.com/Computer-Algorithms-Introduction-Design-Analysis/dp/0201612445

MOOC Course

1. https://www.coursera.org/learn/algorithm-design-analysis
2. http://www.online.stanford.edu/course/algorithms-design-and-analysis-part-1
3. https://www.onlinecourses.nptel.ac.in/noc16_cs04/preview