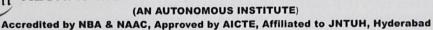
KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY





B. Tech. in COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

III Year I Semester Syllabus (KR23) ALGORITHM DESIGN AND ANALYSIS (23DI502PC) Common for CSE (DATA SCIENCE) and IT

L T P C 3 0 0 3

Pre-requisites/ Co-requisites:

Kmit

- 1. 23CS103ES-Programming for Problem Solving
- 2. 23CC402PC-Data Structures
- 3. 23CC305PC- Object Oriented Programming through Java

Course Objectives: The course will help to

- 1. Introduce the notations for analysis of the performance of algorithms and recursion.
- 2. Relate major algorithmic techniques (divide-and-conquer, greedy) and mention problems for which each technique is appropriate.
- 3. Introduce the applications of graphs and trees.
- 4. Understand dynamic programming with applications.
- 5. Understand Branch and Bound technique and introduce P, NP problems.

Course Outcomes: After learning the concepts of the course, the student is able to

- Analyse the performance of algorithms and illustrate the use of divide and conquer in applications.
- 2. Illustrate the use of greedy method and binary search in real world applications.
- 3. Apply BFS, DFS and backtracking in different applications.
- 4. Develop different applications using dynamic programming.
- 5. Design different applications of branch and bound and understand P, NP problems.

UNIT-I

Introduction: Algorithm, Performance Analysis-Space Complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation.

Recursion: Introduction, Fibonacci sequence, Climbing Stairs, Reverse String, Happy Number, Greatest Common Divisor, Strobogrammatic Number II.

Divide and Conquer: General method, Master Theorem, Applications: Quick sort, Merge sort, Majority Element, Calculate pow(x,n).

UNIT - II

Binary Search- Introduction, Applications: Median of two sorted arrays, Find the fixed point in a given array, Find Smallest Common Element in All Rows, Longest Common Prefix, Koko Eating Bananas.

Greedy Method: General method – Applications – Minimum product subset of an array, Best Time to Buy and Sell Stock, Knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT - III

Breadth First Traversal and Depth First Traversal: BFS Introduction, Applications: Find All The Lonely Nodes, Max Area of Island, Number of Distinct Islands. DFS Introduction, Applications: The Maze, Boundary of Binary Tree.

Trees: Binary Tree Introduction, Applications: Symmetric Tree, Balanced Binary Tree, Average of

Levels in Binary Tree, Find Largest Value in Each Tree Row, Binary Tree Right Side View.

Backtracking: General method, Applications: N Queens Problem, Hamiltonian Cycle, Brace Expansion, Gray Code, Path with Maximum Gold, Generalized Abbreviation, Campus Bikes II.

UNIT-IV

Dynamic Programming: Introduction, DP Techniques, Applications – Matrix Chain Multiplication, Optimal Binary Search Tree, All Pairs Shortest Paths, Traveling Salesperson Problem, Climbing Stairs, Min Cost Climbing Stairs, Maximum Sub Array, Number of Corner Rectangles, 0/1 Knapsack Problem.

Strings Problems: Introduction, Count Substrings with Only One Distinct Letter, Valid Word Abbreviation, Longest Repeating Substring, Longest Common Subsequence, Longest Increasing Subsequence.

UNIT-V

Branch and Bound: General Method, FIFO Branch and Bound, LC Branch and Bound, Applications: 0/1 knapsack Problem, Traveling Salesperson Problem.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cook's theorem.

TEXT BOOKS:

- Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Raja sekharan, University Press.
- Introduction to Algorithms, Thomas H Coremen, Charles E. Leiser, Ronald L. Rivest, Clifford Stein, 3rd edition, 2009.
- 3. Design and Analysis of Algorithms: A Contemporary Perspective, Cambridge University Press, Sandeep Sen, Amit Kumar, 2019

REFERENCE BOOKS: