

**VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY NAMBUR-522508 ANDHRA PRADESH, INDIA**

**YEAR :** III B.Tech **SEMESTER:**II

**COURSE NAME:** DESIGN AND ANALYSIS OF ALGORITHMS

**COURSE CODE:** XXXXXXXX

**BRANCH:** COMMON TO CSE & IT BRANCHES

**PREREQUISITE:** Knowledge of programming language(s) and basic Algorithms

**COURSE OBJECTIVE:** To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms, to introduce the different algorithmic approaches for problem solving through numerous example problems, and to provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**COURSE OUTCOMES:** Students will be able to:

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| **SN** | **OUTCOME** | **Cognitive Levels as per Bloom’s Taxonomy** | **Weightage (%)** |
| CO1 | Infer the divide-and-conquer paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. Derive and solve recurrences describing the performance of divide-and-conquer algorithms. | L1,L2,L3, L4 | 20 |
| CO2 | Infer the greedy paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. | L1,L2,L3, L4 | 20 |
| CO3 | Infer the dynamic-programming paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. | L1,L2,L3, L4 | 20 |
| CO4 | Infer the backtracking paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. | L1,L2,L3, L4 | 20 |
| CO5 | Infer the branch and bound paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. | L1,L2,L3, L4 | 20 |

**WEIGHTAGE OF BLOOM’S LEGENDS & PERCENTAGEOF QUESTIONS IN EXAMINATIONS:**

L1 (Remembering) = 30- 40%, L2 (Understanding) = 30 - 40%,

L3 (Applying) = 10-20 %, L4 (Analysing) = 10 - 20%,

Easy (%) = 15%-20%, Average (%)= 60% - 70%, Difficult (%)= 15% - 20%

TOTAL = L1 + L2 + L3 + L4 = 100%(on an average about 2minutes per mark)

**Note:** This specification weightage in above shall be treated as a general guideline for students, teachers and paper setters. The actual distribution of marks in the question paper may vary slightly.

**DETAILED SYLLABUS:**

**UNIT-1: INTRODUCTION:** Algorithm Definition, Algorithm Specification, Performance Analysis, Performance Measurement, Asymptotic notations.

**DIVIDE AND CONQUER:** General Method, Binary Search, Finding the Maximum and Minimum, Quick Sort.

**UNIT-II:** **THE GREEDY METHOD:** The General Method, Knapsack Problem, Single Source Shortest Path Problem, Optimal Storage on Tapes Problem, Optimal Merge Patterns Problem

**UNIT-III: DYNAMIC PROGRAMMING:** The General Method, 0/1 Knapsack Problem, Single Source Shortest Path – General Weights, All Pairs-Shortest Paths Problem, Traveling Salesperson Problem, String Editing Problem.

**UNIT-IV: BACKTRACKING:** The General Method, The N-Queens Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycles Problem.

**UNIT-V: BRANCH AND BOUND:** The General Method, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack Problem, Travelling Salesperson Problem.

**NP-HARD AND NP-COMPLETE PROBLEMS:** Basic concepts, Cook’s Theorem.

**TEXTBOOKS:**

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Al-gorithms”, 2nd Edition, Universities Press

**REFERENCEBOOKS:**

1. Harsh Bhasin, “Algorithms Design & Analysis”, Oxford University Press.
2. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press.

**ONLINE REFERENCES:**

1. http://nptel.ac.in/courses/106101060/

**MICRO-SYLLABUS:**

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| **Unit** | **Module** | **Micro content** |
| 1 | Algorithm Analysis | Definition and Algorithm Specification |
| Performance Analysis – time and space complexity |
| Performance Measurement – step count and frequency count |
| Asymptotic Notations – Big Oh, Big Omega, Big Theta |
| Divide and Conquer | General Method |
| Binary Search – Procedure, Example, Algorithm, and Computing Time Complexity. |
| Finding the Maximum and Minimum - Procedure, Example, Algorithm, and Computing Time Complexity. |
| Quick Sort - Procedure, Example, Algorithm, and Computing Time Complexity. |
| **Unit** | **Module** | **Microcontent** |
| 2 | Greedy Method | General Method |
| Knapsack Problem - Description, Example, Algorithm. |
| Optimal Storage on Tapes Problem - Description, Example, Algorithm. |
| Single Source Shortest Path Problem - Description, Example, Algorithm. |
| Optimal Merge Patterns Problem - Description, Example, Algorithm. |
| **Unit** | **Module** | **Microcontent** |
| 3 | Dynamic Programming | The General Method |
| 0/1 Knapsack Problem - Description, Example. |
| Single Source Shortest Path – General Weights - Description, Example, Algorithm. |
| All Pairs-Shortest Paths Problem - Description, Example, Algorithm. |
| Travelling Salesperson Problem - Description, Example. |
| String Editing Problem - Description, Example. |
| **Unit** | **Module** | **Microcontent** |
| 4 | Backtracking | The General Method |
| The 8-Queens Problem - Description, State Space Tree, Algorithm. |
| The sum of Subsets Problem - Description, Example, State Space Tree, Algorithm. |
| Graph Coloring Problem - Description, Example, State Space Tree, Algorithm. |
| Hamiltonian Cycles Problem - Description, Example, State Space Tree, Algorithm. |
| **Unit** | **Module** | **Microcontent** |
| 5 | Branch and Bound | The General Method |
| FIFO Branch and Bound |
| LC Branch and Bound |
| 0/1 Knapsack Problem - Description, Example. |
| Travelling Salesperson Problem - Description, Example. |
| NP-Hard and NP-Complete problems | Basics Concepts. |
| Cook’s Theorem. |

Code No :

**R20**

**III B. TECH II SEMESTER REGULAR EXAMINATION MODEL PAPER**

**MICROPROCESSORSANDMICROCONTROLLERS**

**(COMMON TO ECE & EEE BRANCHES)**

**Time : 3 Hours Max. Marks : 70**

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**Note :** Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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| UNIT-I | | | | CO | BL |
| 1. | a) | Discuss various asymptotic notations used to represent complexity of algorithms with examples. | [7M] | CO1 | L2 |
| b) | Write algorithm for Min Max Problem. | [7M] | CO1 | L3 |
| (OR) | | | |  |  |
| 2. | a) | Discuss Quick sort with an example and derive its time complexity in worst case. | [7M] | CO1 | L2 |
| b) | Write algorithm for calculating multiplication of matrices and derive its time complexity using step count method. | [7M] | CO1 | L3 |
| UNIT-II | | | |  |  |
| 3. | a) | Find an optimal solution to the knapsack instance n=5 objects and the capacity of knapsack m=10. The profits and weights of the objects are (P1, P2, P3, P4, P5) = (15, 7, 6, 18, 3), (W1, W2, W3, W4, W5) = (5, 7, 1, 4, 1) respectively. | [7M] | CO2 | L1 |
| b) | Define optimal merge pattern? Find optimal merge pattern for ten files whose record lengths are 28, 32, 12, 5, 84, 53, 91, 35, 3, and 11. | [7M] | CO2 | L1 |
| (OR) | | | |  |  |
| 4. | a) | Find shortest paths in the following graph using Dijkstra’s algorithm. | [14M] | CO2 | L1 |
| UNIT-III | | | |  |  |
| 5. | a) | Define merging and purging rules in 0/1 knapsack problem and explain with an example.. | [7M] | CO3 | L2 |
| b) | Write and explain an algorithm to compute the all pairs shortest path using dynamic programming and prove that it is optimal. | [7M] | CO3 | L3 |
| (OR) | | | |  |  |
| 6. | a) | Explain the methodology of Dynamic programming. Mention the applications of Dynamic programming. | [7M] | CO3 | L2 |
| b) | Let X = a,a,b,a,a,b,a,b,a,a and Y = b,a,b,a,a,b,a,b. Find a minimum-cost edit sequence that transforms X and Y. | [7M] | CO3 | L1 |
| UNIT-IV | | | |  |  |
| 7. | a) | Explain the Graph–Coloring problem and draw the state space tree for m= 3 colors and n=4 vertices graph. | [7M] | CO4 | L2 |
| b) | Write an algorithm to determine the Hamiltonian Cycle in a given graph using backtracking. | [7M] | CO4 | L3 |
| (OR) | | | |  |  |
| 8. | a) | Find all possible subsets of *w* that sum to *m.* Let w={5,7,10,12,15,18,20}and *m*=35 and construct the portion of the state space tree that is generated using backtracking. | [7M] | CO4 | L3 |
| b) | Illustrate the process of backtracking on the 8 Queens problem. Explain with a suitable example. | [7M] | CO4 | L2 |
| UNIT-V | | | |  |  |
| 9. | a) | State the concept of branch and bound method and mention its applications. | [7M] | CO5 | L1 |
| b) | Discuss 0/1 Knapsack problem with respect to branch and bound method. | [7M] | CO5 | L2 |
| (OR) | | | |  |  |
| 10. | a) | Deduce an optimal tour of the following travelling salesperson problem using LCBB.  Screenshot 2021-11-30 134550 | [14M] | CO5 | L4 |

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**THE ABOVE MODEL PAPER ATTAINMENTS OF BLOOM’S TEXONOMY AS FOLLOWS**

**L1: 4\*7 + 1\*14 = 42= 30%**

**L2: 7\*7 = 49 = 35%**

**L3: 5\*7 = 35 = 25%**

**L4: 1\*14 = 14 = 10%**

SIGNATURES OF

COURSE COORDINATER MODULE COORDINATER HOD