

Exam. Code : 206702

Subject Code : 3523

M.Sc. (Computer Science) Semester—II

MCS-203 : DESIGN & ANALYSIS OF ALGORITHMS

Time Allowed—3 Hours]

[Maximum Marks—100

**Note** :— Attempt any **FIVE** questions. All questions carry equal marks.

1. (a) What are the features of an algorithm ? What is the need of obtaining the time and space complexity measures of an algorithm ?  
(b) With the help of an example, explain how a recursive algorithm can be represented by recurrence relation. Solve the following recurrence :  $T(n) = 3T(n/2) + n$ .  
10,10
2. (a) What is the notion behind divide and conquer method ? Show the various steps involved in the quick sorting of (1, 3, 4, -5, 9, 2, 6, 5, 3).  
(b) Explain the algorithm for finding maximum and minimum of a list of numbers, and analyze its time complexity. 10,10
3. (a) Explain Kruskal's algorithm for minimum cost spanning tree and its complexities. Analyze it with an example.

- (b) Define knapsack problem and its importance. What is the relevance of greedy method to solve knapsack problem ? 10,10
4. (a) Explain how to solve travelling salesman problem by the method of dynamic programming and analyze complexity of the algorithm.
- (b) Write a note on multistage graph problem. 10,10
5. (a) Explain the use of Backtracking method of solving Eight Queens Problem giving its algorithm.
- (b) What is m-colorability graph problem ? Give the formulation for explicit and implicit constraints in case of m-colorability graph problem with  $n$  nodes. 10,10
6. (a) Prove/Give counter example . A graph with  $n$  nodes and more than  $n - 1$  edges must contain a cycle.
- (b) Give the algorithm for Depth First Search of a Graph. Also define "Articulation Point" of the graph and explain how to find it.
- (c) Draw the binary search tree that results from inserting the integers 57, 85, 35, 9, 47, 20, 26, 99, 93, 10 starting with 57 and ending with 10. What is the preorder and postorder traversal of your tree. 5,10,5



7. (a) Explain the use of Divide and Conquer Technique for Binary Search Method. Give the algorithm for Binary Search Method. What is the complexity of Binary Search Method ?
- (b) What are Algebraic Algorithms ? What is Modular arithmetic ? Explain the concepts of modular inverses and exponentiation. 10,10
8. (a) Differentiate between deterministic and non-deterministic algorithm. Explain P and NP problems giving examples.
- (b) Compare NP-Hard with NP-Complete problems. Is there any NP-Hard problem, which is also NP ? If yes, give an example. if no, why ? 10,10