(i) **Printed Pages : 4**   Roll No. ....

(ii) **Questions   : 9**   Sub. Code : $\boxed{3}\boxed{6}\boxed{0}\boxed{8}$

Exam. Code : $\boxed{0}\boxed{4}\boxed{5}\boxed{9}$

M.Sc. Information Technology 1ˢᵗ Semester

(2123)

COMPUTER ALGORITHMS

Paper : MS-62

Time Allowed : Three Hours]   [Maximum Marks : 80

Note :—Attempt **FIVE** questions in all, including Question No. **1** in Section-A, which is compulsory and taking **ONE** each from Section-B to Section-E. Marks are indicated on the right of various questions.

SECTION—A

(Compulsory Question)

1. (a) Assume that an $O(\log_2^N)$ algorithm runs for 12 milliseconds when the input size is 64. What is the size of the input that makes the algorithm run for 16 milliseconds ?

    (b) Design a recursive algorithm for binary search and compute its time complexity.

    (c) What is m-colorability graph problem ? How do you find all m-colorings of a graph ?

    (d) What is the principle behind Bellman-Ford algorithm to detect the negative weight cycles in a graph ?

    4,4,4,4

SECTION—B

2. (a) Explain the general plan of mathematical analysis of non-recursive algorithms with an example.

   (b) What is a binary tree ? Develop algorithms for in-order, pre-order and post-order traversal of a tree ?   8,8

3. (a) Define algorithm. Discuss the criteria of an algorithm with an example. Also define time and space complexity of an algorithm.

   (b) The running time of an algorithm is represented by the following recurrence relation :

$$T(n) = \begin{cases} n & n \leq 3 \\ T\left(\dfrac{n}{3}\right) + cn & \text{otherwise} \end{cases}$$

   Represent the time complexity of the algorithm in θ-notation.   8,8

SECTION—C

4. (a) Given the array [8, 3, 2, 9, 7, 1, 5, 4], show the state of the array after each pass when the Merge Sort algorithm is applied on the original array.

   (b) Explain how Strassen's approach differs from the ordinary matrix multiplication algorithm. Derive the time complexity required by Strassen's matrix multiplication.   8,8

5. Define spanning tree and minimum spanning tree. Find the minimum spanning tree for the graph shown below by using Kruskal's algorithm : 16
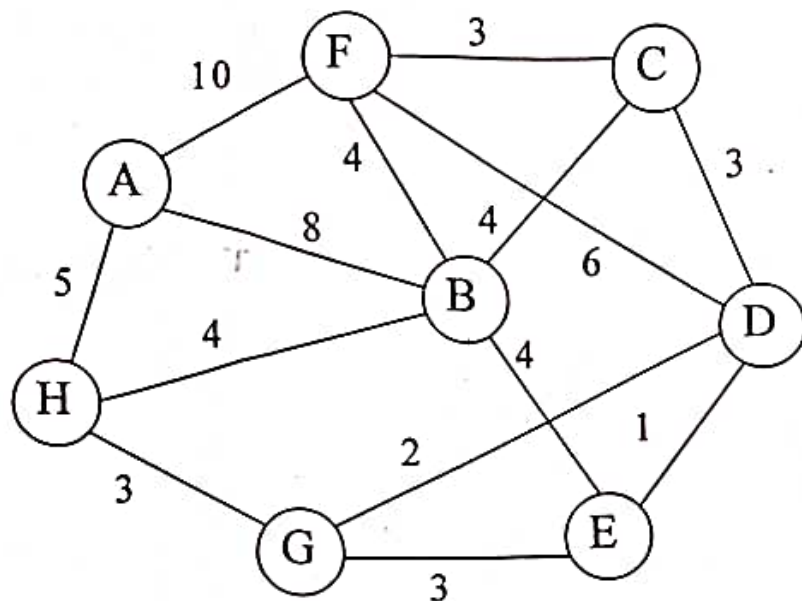
SECTION—D

6. How is dynamic programming approach to problem solving different from divide-and-conquer approach ? Explain the Floyd's algorithm for finding the All Pair Shortest Path (APSP) for every pair of nodes in the graph. 16

7. Explain in detail how the technique of backtracking can be applied to solve the 8-queens problem. Present an algorithm for this and analyze. 16

SECTION—E

8. What is bounding and how these bounds are useful in Branch and Bound methods ? Explain the method of reduction to solve Traveling Sales Persons problem using Branch and Bound. 16

9. (a) Discuss the relationship between class P, NP, NP-Complete and NP-Hard problems with suitable example of each class.

(b) Define NP scheduling problem. Discuss the scheduling of identical processors problem with an example.

8,8