Exam. Code : 206701
Subject Code : 4679

M.Sc. (Computer Science) 1st Semester

DISCRETE STRUCTURES

Paper—MCS-104

Time Allowed—Three Hours] [Maximum Marks—100

Note :—Attempt **FIVE** questions in all, taking at least **ONE** question from each section. The **fifth** question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. (a) Is the function $y = f(x) = 3x + 2$, $x, y \in R$ onto ? Is it one-to-one ? What if $x, y \in Z$? Explain.

   (b) Prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$.

2. Define a relation R on the set of natural numbers : a R b if and only if $| a - b | < 3$. Is R reflexive ? Is R symmetric ? Is R transitive ? Give reasons for your answers.

SECTION—B

3. (a) What is minimum spanning tree ? With the help of an example illustration, explain the basic concepts and terminology of minimum spanning tree.

(b) Define planar graph and show that the following graphs are planar [8 + 8]

(i) Graph of order 5 and size 8

(ii) Graph of order 6 and size 12.

4. (a) State the technique to determine whether a Hamiltonian cycle exists in a graph or not.

(b) Find the chromatic number of :

(i) a cycle

(ii) a complete graph (K_n)

(iii) a bipartite graph $K_{m,n}$.

SECTION—C

5. A shop window designer has 7 balloons, of which 1 is white, 2 are blue and 4 are red. She hangs these balloons in a line in the shop front. Find the number of arrangements she can make by using :

(a) all 7 balloons,

(b) exactly 6 balloons.

6. Solve the recurrence relation by substitution :

$a_n = a_{n-1} + n \times 3^n$ where $a_0 = 1$.

SECTION—D

7. (a) If A and B are ideals of a ring R, prove that the sum $A + B = \{a + b \mid a \in A, b \in B\}$ is also an ideal of R.

(b) Prove that the intersection of any two subfields of a field F is also a subfield of F.

8. Define Boolean algebra. What are the application of Boolean algebra in logic circuits and switching functions ? Give examples.