

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (CSE-2011 Batch)/(IT-2011 Batch) (Sem.-3rd)

**DISCRETE STRUCTURES**

Subject Code : BTCS-302

Paper ID : [A1124]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

**1. Answer briefly :**

- (a) Define an equivalence relation on a set A. Explain with the help of an example.
- (b) Define a partial order on the set N of all natural numbers.
- (c) Give an example each of a commutative ring with identity and a field.
- (d) Make a table of all Boolean functions of degree 2.
- (e) Compute the number of distinct five-card hands that can be dealt from a deck of 52 cards.
- (f) Give an example of a linear homogeneous recurrence relation of degree 2.
- (g) Is the set Z of integers with the binary operation of subtraction a semi-group ? Justify your answer.
- (h) Prove that there exists a semi-group which is not a monoid.
- (i) Define a simple path in a graph.
- (j) Give an example of a connected graph.

**SECTION-B**

2. Let  $A = \{a, b, c, d\}$  and  $B = \{1, 2, 3\}$ . Determine whether the relation  $R$  from  $A$  to  $B$  given by  $R = \{(a, 1), (b, 2), (c, 1), (d, 2)\}$  is a function or not. Justify your answer. (5)
3. Show that  $x\bar{y} + y\bar{z} + \bar{x}z = \bar{x}y + \bar{y}z + x\bar{z}$  where  $x, y, z$  are Boolean variables. (5)
4. Show that among 100 people there are at least 9 who were born in the same month. (5)
5. Give an example of a non-abelian group of order 8. (5)
6. Prove that  $K_5$  the complete graph on 5 vertices is not planar. (5)

**SECTION-C**

7. (a) What is the chromatic number of  $C_n$  – the cycle with  $n$  vertices ? (5)  
(b) Prove that an undirected graph has an even number of vertices with odd degree. (5)
8. Solve the recurrence relation :  
 $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$  with the initial conditions  
 $a_0 = 2, a_1 = 5, a_2 = 15.$  (10)
9. (a) What is a hashing function ? Give one example of an application of hashing functions. (5)  
(b) Construct a circuit using inverters, AND gates and OR gates to produce the output  $xyz + \bar{x}\bar{y}\bar{z}$ . (5)