Roll No. ..... Total Pages : 04

BT-4/M-23 44151

DISCRETE MATHEMATICS

PC-CS-202A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (i) In a survey of 300 students, 64 had taken a Mathematics course, 94 had taken a English course and 58 had taken a Computer course. 28 had taken Mathematics and Computer course, 26 had taken English and Mathematics course and 22 had taken English and Computer course. 14 had taken all three courses :

   (a) Draw the Venn diagram for the same.

   (b) How many students were surveyed who had taken none of the three courses ?

   (c) How many had taken Computer only ?

   (d) How many had taken Mathematics only ?

   (e) How many had taken English course but not Mathematics course and Computer course ?

12

(ii) Prove that :

$$(B^c \cap U) \cap (A^c \cup \Phi) = (A \cup B)^c.$$ 3

2. (i) Differentiate Universal and Existential Quantifiers with suitable examples.show that $P \rightarrow (Q \rightarrow R)$ is equivalent to $(P \wedge Q) \rightarrow R$. 7.5

(ii) Differentiate DNF and CNF with suitable examples. Obtain DNF of $(P \rightarrow Q) \wedge (\neg P \wedge Q)$. 7.5

Unit II

3. (i) Define Relations. Explain various properties of relations. 7.5

(ii) Let A={*a*, *b*, *c*, *d*}. Determine the types of the following relations : 7.5

(a) R_1 = {(*a*, *a*), (*b*, *b*), (*a*, *c*), (*c*, *c*), (*d*, *d*), (*c*, *a*)}

(b) R_2 = {(*a*, *b*), (*b*, *a*), (*c*, *d*), (*d*, *c*)}

(c) Check whether R_1 is Equivalence relation or not.

4. Let D_{100} = {1, 2, 4, 5, 10, 20, 25, 50, 100} and let the relation $\leq$ be the relation (divides) be a partial ordering on D_{100} (a) Determine GLB and LUB, maximal element and minimal element of B, where B ={10, 20}, (b) Determine GLB and LUB, maximal element and

minimal element of B = {5, 10, 20, 25}. (c) Also draw hasse diagram for D_{100}, (d) Define Lattice and Check D_{100} forms lattice or not justify your answer. 15

Unit III

5. (i) A box contains 6 white balls and 5 red balls. In how many ways, 4 balls can be drawn from the box if (a) They can be of any color (b) Two balls are white and two are red. (c) All balls are of same color ? 9

   (ii) Differentiate Injective and Surjective functions with suitable examples. 6

6. (i) Find the particular solution of the difference equation $a_{r+2} - 2a_{r+1} + a_r = 3r + 5$. 7.5

   (ii) State Pigeon Hole Principle. Explain with suitable examples. 7.5

Unit IV

7. Define Group. Write various properties of a Group. Consider (G, *) be an algebraic system. G is set of non-zero real numbers, where * is defined by a*b = ab/4. Show that (G, *) is a Group. 15

8. Define Semigroup. Write properties of semigroup. Consider the set N of positive integers, and *be the operation of l.c.m (least common multiple) on N. (a) find 4*6, 3*5, 9*18, 1*6 (b) Is (N, *) a semigroup ? Justify your answer. (c) Find identity element of *. 15