[This question paper contains 2 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 13853 **L**

Unique Paper Code : 32355213

Name of the Paper : GE: Discrete Mathematics

Name of the Course : **Other than Maths (Hons.) (CBCS-LOCF)**

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions are compulsory.
3. Attempt any **two** parts from each questions.

1.

a) Construct the truth table for the logical statement:

$$(p \vee q) \leftrightarrow [\, (\neg p \wedge r) \rightarrow (q \wedge r)\,].$$

6

b) Let $A = \mathbb{Z}^+$ (the set of positive integers). Define a relation R on A by:
$a\,R\,b$ if and only if $|a - b| \leq 2$.
Determine whether the relation R is:
Reflexive
Antisymmetric
Transitive. 6

c) Show that

$$[(p \vee q) \vee ((q \vee \neg r) \wedge (p \vee r))] \Leftrightarrow \neg(\neg p \wedge \neg q).$$ 6

2.

a) Define a partially ordered set (POSET). Show that $(P(\{a, b, c\}, \subseteq)$ partially ordered sets. 6.5

b) Show that $(P(\{1, 2, 3\}, \subseteq)$ is a lattice. 6.5

c) Define the maximum element of a set. Find gcd(1800, 756). 6.5

3.

a) Determine whether or not each of the following integers is a prime
(I) 9833
(II) 55, 551, 111 6

b) Use the fundamental theorem of Arithmetic to prove that for no natural number n does the integer 6^n terminate in 0. 6

P.T.O.

c) Prove by mathematical induction that $1+2+3+....+n=\frac{n(n+1)}{2}$ for any natural number n. 6

4.

a) Solve the recurrence relation $a_n = 3a_{n-1},\ n \geq 1$ given $a_0 = 1$. 6.5

b) How many integers between 1 and 500 are :

(i) divisible by 3 or 5?

(ii) divisible by 3 but not 5 or 6? 6.5

c) There are 15 questions on a multiple choice exam and five possible answers to each question.

(i) In how many ways can be exam by answered?

(ii) In how many ways can the exam be answered with exactly 8 answers correct? 6.5

5.

a) If L and M are Lattices, then show that $L{\times}M$ is also a lattice. 6

b) Let $L = (\{0, l, m, 1\}, \leq)$ and $M = (\{x, p, q,\}, \leq)$ be two Lattices. Define a mapping $g: L \rightarrow M$ such that $g(0) = p$, $g(l) = g(m) = x$ and $g(1) = q$. Then determine if g *is*

i. join homomorphism,

ii. meet homomorphism,

iii. homomorphism

iv. order homomorphism 6

c) Define Lattice as an algebra. Let L be the set of divisors of 30 equipped with divisibility order. Find the complement of each member of L. 6

6.

a) Put the function $f(x_1, x_2, x_3) = x_1 \wedge (x_2 \vee x_3)$ in the conjunctive normal form. 6.5

b) Find the minimal form of $f = x'yz + x'yz' + x'y'z + xy'z' + xy'z$ 6.5

c) Determine the symbolic representation of the circuit $P = (x_1' + x_2)'x_3$ 6.5