LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

SIXTH SEMESTER – **APRIL 2019**

MT 6608– DISCRETE MATHEMATICS

Date: 08-04-2019 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

SECTION - A

ANSWER ALL QUESTIONS: 10 X 2 = 20

1) Construct the truth table for $P \wedge \neg P$.
2) Write the dualof $\neg(P \vee Q) \wedge \left(P \vee \neg\left(Q \wedge \neg S\right)\right)$.
3) Write down the min terms of P and Q
4) Obtain the principle disjunctive normal forms of (i) $P \to Q$ (ii) $\neg\left(P \wedge Q\right)$.
5) Define semi group.
6) Give an example of (i) finite cyclic monoid and (ii) infinite cyclic monoid.
7) Define sub Lattice.
8) Let $S = \{a, b\}$. Draw the diagram of $\left\langle \circ \left(S\right), \subseteq \right\rangle$.
9) Define Boolean Algebra.
10) Define Boolean homomorphism.

SECTION - B

ANSWER ANY FIVE QUESTIONS: 5 X 8 = 40

11) Construct the truth table for $\neg(P \wedge Q) \Leftrightarrow \left(\neg P \vee \neg Q\right)$.
12) Show that $\left(\left(P \vee Q\right) \wedge \neg\left(\neg P \wedge \left(\neg Q \vee \neg R\right)\right)\right) \vee \left(\neg P \wedge \neg Q\right) \vee \left(\neg P \wedge \neg R\right)$ is a tautology.
13) Obtain the principle disjunctive normal forms of $P \to \left(\left(P \to Q\right) \wedge \neg\left(\neg Q \vee \neg P\right)\right)$.
14) Write the following sentences in the symbolic form
    (i) Ram opened the book and started to read.
    (ii) Mark is rich or unhappy.
    (iii) If the Sun is shining today, then there is no raining.
15) Prove that the composition of semigrouphomomorphisms is also a semigroup homomorphism.
16) Let $\langle L, \leq \rangle$ be a Lattice. Then prove that for any $a, b, c \in L$, the inequality $a \oplus \left(b * c\right) \leq \left(a \oplus b\right) * c$ holds.
17) Let $\langle L, \leq \rangle$ be a Lattice. Then prove that for any $a, b \in L$, $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$.
18) Obtain the values of the Boolean forms (i) $x_1 * \left(x_1' \oplus x_2\right)$ (ii) $x_1 * x_2$ (iii) $x_1 \oplus \left(x_1 * x_2\right)$

SECTION - C

ANSWER ANY TWO QUESTIONS: **2 X 20 = 40**

19) (a) Construct the truth table for the following statements (i) $(P \to Q) \wedge (Q \to P)$

(ii) $(P \vee Q) \vee \neg P$

(b) Obtain the p.d.n.f. of $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$ **(10+10)**

20) (a) Define monoid and construct Cayley's table for $\langle \ {}_5, +_5 \rangle$ and $\langle \ {}_5, \times_5 \rangle$.

(b)Prove that for any commutative monoid $(M, *)$, the set of all idempotent elements of M forms a submonoid. **(10+10)**

21) (a) State and prove any four properties of Lattices.

(b) Define Lattice homomorphism andLattice endomorphism. **(16+4)**

22) (a) Show that $\left(x_1' * x_2' * x_3' * x_4'\right) \oplus \left(x_1' * x_2' * x_3' * x_4\right) \oplus \left(x_1' * x_2' * x_3 * x_4\right) \oplus \left(x_1' * x_2' * x_3 * x_4'\right) = x_1' * x_2'$

(b) Let B be a Boolean algebra. Then prove that (i) $(a \oplus b)' = a' * b'$ (ii) $(a * b)' = a' \oplus b'$

(10+10)