DALMIA HIGHER SECONDARY SCHOOL DALMIAPURAM – 621651

Std : 12 MATHEMATICS TIME: 1.50HRS

CHAPTER – 12 TEST -1 MARKS : 50

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2 MARKS : ANSWERS ANY 10 Q **10 X 2 = 20**

1. Examine the binary operation (closure property) of the following operations on the respective sets (if it is not, make it binary): a * b = a + 3 ab – $5b^2$; ∀ a , b ∈′

2. Examine the binary operation (closure property) of the following operations on the respective sets (if it is not, make it binary): a * b = $\left(\frac{a-1}{b-1}\right)$, ∀ $a , b \neq 1 \in \mathbb{Q}$

3. Let A = $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. Find A ∨ B and A ∧ B.

4. Write the statements in words corresponding to ¬p, p ∧q,p∨qand q ∨¬p, where p is 'It is cold' and q is 'It is raining.'

5. Establish the equivalence property: p⟶ q ≡ ¬p ∨ q

6. Establish the equivalence property connecting the bi-conditional with conditional:
p ↔ q≡ (p⟶ q)∧ (q⟶ p)

7. Fill in the following table so that the binary operation ∗on A= {a,b,c} is commutative.

*	a	b	c
a	b		
b	c	b	a
c	a		c

8. Write each of the following sentences in symbolic form using statement variables p and q .

(i) 19 is not a prime number and all the angles of a triangle are equal.

(ii) 19 is a prime number or all the angles of a triangle are not equal

9. Which one of the following sentences is a proposition?

(i) 4 + 7 = 12 (ii) What are you doing? (iii) $3^n \leq 81$, n∈∞

(iv) Peacock is our national bird (v) How tall this mountain is!

10. Verify whether the following compound propositions are tautologies or contradictions or contingency ((p ∧ q) ∧¬(p ∨ q)

3 MARKS : ANSWERS ANY 10 Q **10 X 3 = 30**

11. Verify (i) closure property, (ii) commutative property, (iii) associative property, (iv) existence of identity, and (v) existence of inverse for the operation $\times_{11}$ on a subset A = {1,3,4,5,9} of the set of remainders {0,1,2,3,4,5,6,7,8,9,10}.

12. Show that p→q and q→p is not equivalent

13. Verify the (i) closure property, (ii) commutative property, (iii) associative property (iv) existence of identity and (v) existence of inverse for the arithmetic operation + on Z.

14. Consider the binary operation $*$defined on the set A= {a,b,c,d } by the following table:

*	a	b	c	d
a	a	c	b	d
b	d	a	b	c
c	c	d	a	a
d	d	b	a	c

Is it commutative and associative?

15. Let $A = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{pmatrix}$, $C = \begin{pmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{pmatrix}$

be any three Boolean matrices of the same type. Find (i) $A \vee B$ (ii) $A \wedge B$ (iii) $(A \vee B) \wedge C$ (iv) $(A \wedge B) \vee C$.

16. Verify the (i) closure property, (ii) commutative property, (iii) associative property (iv) existence of identity and (v) existence of inverse for the arithmetic operation - on Z.

17. Verify the (i) closure property, (ii) commutative property, (iii) associative property (iv) existence of identity and (v) existence of inverse for the arithmetic operation + on Z_e= the set of all even integers.

18. Verify the (i) closure property, (ii) commutative property, (iii) associative property (iv) existence of identity and (v) existence of inverse for the arithmetic operation + on Z_o= the set of all odd integers.

19. Verify (i) closure property (ii) commutative property, and (iii) associative property of the following operation on the given set. $(a*b)=a^b$; $\forall a, b \in N$ (exponentiation property)

20. Let $A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$ be any three boolean matricesof the same type. Find (i) $A \vee B$ (ii) $A \wedge B$ (iii) $(A \vee B) \wedge C$ (iv) $(A \wedge B) \vee C$.

21. Using the equivalence property, show that $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$.

22. Write the converse, inverse, and contrapositive of each of the following implication.
(i) If x and y are numbers such that x = y , then $x^2 = y^2$ (ii) If a quadrilateral is a square then it is a rectangle

23. Construct the truth table for the following statements.
(i) $\neg p \wedge \neg q$ (ii) $\neg(p \wedge \neg q)$(iii) $(p \vee q) \vee \neg q$ (iv) $(\neg p \rightarrow r) \wedge (p \leftrightarrow q)$

24. Verify whether the following compound propositions are tautologies or contradictions or contingency
(i) $(p \wedge q) \wedge \neg (p \vee q)$ (ii) $((p \vee q) \wedge \neg p) \rightarrow q$ (iii) $(p \rightarrow q) \leftrightarrow (\neg p \rightarrow q)$ (iv) $((p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow (p \rightarrow r)$

25. Show that (i) $\neg (p \wedge q) \equiv \neg p \vee \neg q$ (ii) $\neg (p \rightarrow q) \equiv p \wedge \neg q$.

26. Prove that $q \rightarrow p \equiv \neg p \rightarrow \neg q$

27. Show that $p \rightarrow q$ and $q \rightarrow p$ are not equivalent

28. Show that $\neg (p \leftrightarrow q) \equiv p \leftrightarrow \neg q$

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CHAPTER – 12 TEST -2 MARKS : 50

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1. Verify (i) closure property, (ii) commutative property, (iii) associative property, (iv) existence of identity, and (v) existence of inverse for following operation on the given set. $m*n=m+n-mn$; $\forall m,n\in Z$

2. Verify (i) closure property, (ii) commutative property, (iii) associative property, (iv) existence of identity, and (v) existence of inverse for the operation $+_5$ on Z_5 using table corresponding to addition modulo 5.

3. Verify (i) closure property, (ii) commutative property, (iii) associative property, (iv) existence of identity, and (v) existence of inverse for the operation $\times_{11}$ on a subset $A = \{1,3,4,5,9\}$ of the set of remainders $\{0,1,2,3,4,5,6,7,8,9,10\}$.

4. (i) Define an operation $*$ on $\mathbb{Q}$ as follows: $a * b = \left(\frac{a+b}{2}\right); a, b \in \mathbb{Q}$. Examine the closure, commutative, and associative properties satisfied by $*$ on $\mathbb{Q}$.

(ii) Define an operation $*$ on $\mathbb{Q}$ as follows: $a * b = \left(\frac{a+b}{2}\right); a, b \in \mathbb{Q}$. Examine the existence of identity and the existence of inverse for the operation $*$ on $\mathbb{Q}$.

5. (i) Let $M = \left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\}\right\}$ and let $*$ be the matrix multiplication. Determine Whether M is closed under $*$. If so, examine the commutative and associative Properties satisfied by $*$ on M.

(ii) Let $M = \left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\}\right\}$ and let $*$ be the matrix multiplication. Determine Whether M is closed under $*$. If so, examine the existence of identity, existence of inverse properties for the operation $*$ on M .

6. (i) Let A be $\mathbb{Q}\backslash\{1\}$. Define $*$ on A by $x*y= x + y - xy$. Is $*$ binary on A? If so, examine the commutative and associative properties satisfied by $*$ on A .

(ii) Let A be $\mathbb{Q}\backslash\{1\}$. Define $*$ on A by $x *y = x + y - xy$. Is $*$ binary on A?If so, examine the existence of identity, existence of inverse properties for the operation $*$ on A.

7. Check whether the statement $p\to(q\to p)$ is a tautology or a contradiction without using the truth table.

8. Prove that $p\to(\neg q\vee r) \equiv \neg p\vee(\neg q\vee r)$ using truth table.