

Date: 21-Jun-2026**Time: 60min****Mathematical Logic****Marks: 20****SECTION A**

Q.1 **Select and write the correct answer for the following multiple choice type of questions:** **(4)**

i Inverse of the statement 'A family becomes literate if the woman in it is literate.' is:

- | | |
|---|---|
| (A) If a family becomes literate, then the woman in it is literate. | (B) If a family does not become literate, then the woman in the family is not literate. |
| (C) If the woman in the family is not literate, then the family does not become literate. | (D) None of these |

ii If $p \wedge q$ is F, $p \rightarrow q$ is F then the truth values of p and q are _____ respectively.

- | | |
|----------|----------|
| (A) T, T | (B) T, F |
| (C) F, T | (D) F, F |

Q.2 **Answer the following questions:** **(2)**

i Is the following sentence is statement in logic? Write down the truth value of the statement:
The Sun is a star.

ii Write the truth value of the statement:

$$2 \times 0 = 0 \text{ and } 2 + 0 = 2.$$

SECTION B

Attempt any TWO of the following questions: **(4)**

Q.3 If the statements p, q are true statements and r, s are false statements, then determine the truth value of the following.

$$[(\sim p \wedge q) \wedge \sim r] \vee [(q \rightarrow p) \rightarrow (\sim s \vee r)]$$

Q.4 Without using truth table prove that :

$$\sim (p \vee q) \vee (\sim p \wedge q) \equiv \sim p$$

Q.5 Construct the truth table for the following statement pattern.

$$(q \rightarrow p) \vee (\sim p \leftrightarrow q)$$

SECTION C

Attempt any TWO of the following questions:

(6)

Q.6 Using truth tables prove the following logical equivalences

$$p \rightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r)$$

Q.7 Write converse, inverse and contrapositive of the following statement.

If surface area decreases then pressure increases.

Q.8 Construct the truth table for the following

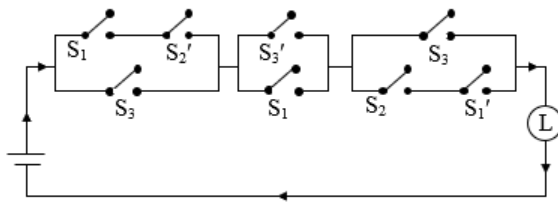
$$[(\sim p \vee q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$$

SECTION D

Attempt any ONE of the following questions:

(4)

Q.9 Express the given circuit in the symbolic form of logic and write the input-output table.



Q.10 Without using truth table prove that $(p \wedge q) \vee (\sim p \wedge q) \vee (p \wedge \sim q) \equiv p \vee q$