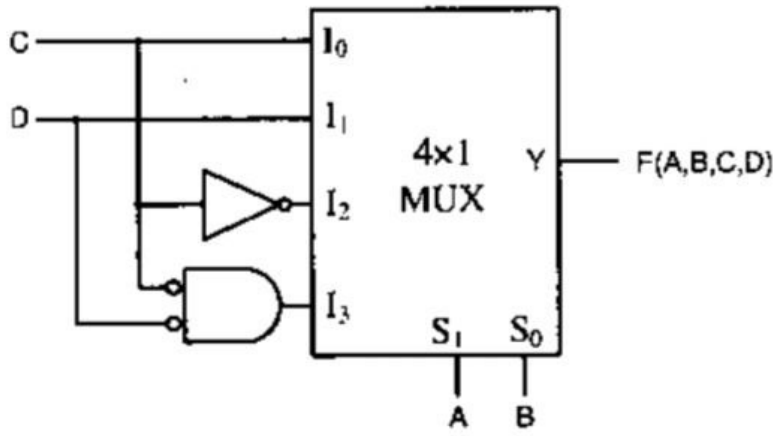
Q.39 The Boolean function realized by the logic circuit shown is



(A) $F = \Sigma m(0,\ 1,\ 3,\ 5,\ 9,\ 10,\ 14)$

(B) $F = \Sigma m(2,\ 3,\ 5,\ 7,\ 8,\ 12,\ 13)$

(C) $F = \Sigma m(1,\ 2,\ 4,\ 5,\ 11,\ 14,\ 15)$

(D) $F = \Sigma m(2,\ 3,\ 5,\ 7,\ 8,\ 9,\ 12)$

Explanation:

- A 4x1 MUX has 2 select lines. Here, $S_1 = A$, $S_0 = B$, so the MUX selects based on the values of AB.
- The inputs are:

$$I_0 = C$$
$$I_1 = D$$
$$I_2 = \overline{C}$$
$$I_3 = C \cdot D$$

- Let's compute the output $F(A, B, C, D)$ for all combinations of A and B, and based on the corresponding I_i.

A	B	S_1S_0	Selected Input	$F(A, B, C, D)$
0	0	00	$I_0 = C$	C
0	1	01	$I_1 = D$	D
1	0	10	$I_2 = \overline{C}$	$\overline{C}$
1	1	11	$I_3 = C \cdot D$	CD

- Now write the full function by substituting all 4-bit combinations $ABCD$, and check when output is 1:

  E.g., for $A = 0, B = 0 \Rightarrow I_0 = C$, so output = C (depends on C). If $C = 1 \Rightarrow F = 1$, otherwise 0. Do this for all 16 combinations.

- The final function gives minterms:

$$F = \Sigma m(2,\ 3,\ 5,\ 7,\ 8,\ 12,\ 13)$$

- So the correct option is **(B)**.