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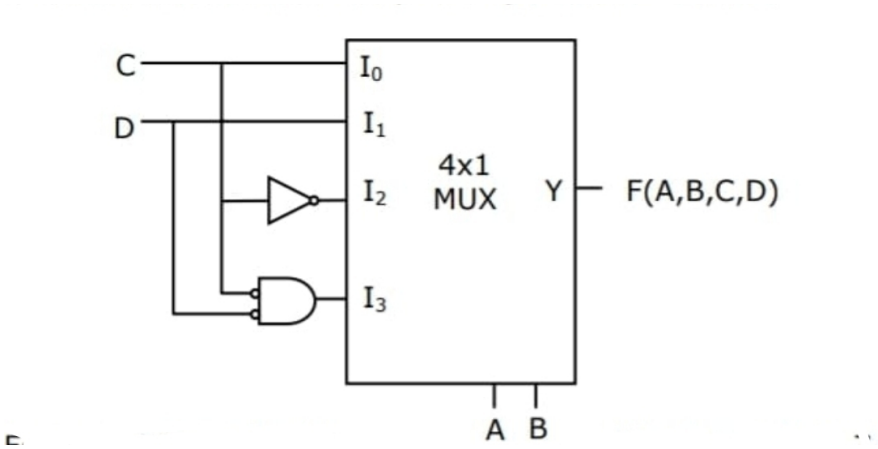
GATE QUESTION
ECE 2010 Q39

Q39. The Boolean function realized by the logic circuit shown is:



Options:

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

Solution :

Output of the MUX can be written as:

$$F = I_0\overline{S_0}\,\overline{S_1} + I_1 S_0\,\overline{S_1} + I_2\overline{S_0}S_1 + I_3 S_0 S_1$$

Here,

$$I_0 = C, \quad I_1 = D, \quad I_2 = \overline{C}, \quad I_3 = CD$$

and

$$S_0 = A, \quad S_1 = B$$

So,

$$F = C\,\overline{A}\,\overline{B} + DA\,\overline{B} + \overline{C}\,\overline{A}B + CDAB$$

Writing all SOP terms:

$$F = \overline{A}\,\overline{B}\,C\,\overline{D} + \overline{A}\,\overline{B}\,CD + \overline{A}B\,\overline{C}\,\overline{D} + \overline{A}B\,\overline{C}D + A\,\overline{B}\,D\,\overline{C} + A\,\overline{B}\,DC + ABCD$$

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

Hence, (D) is the correct option.