

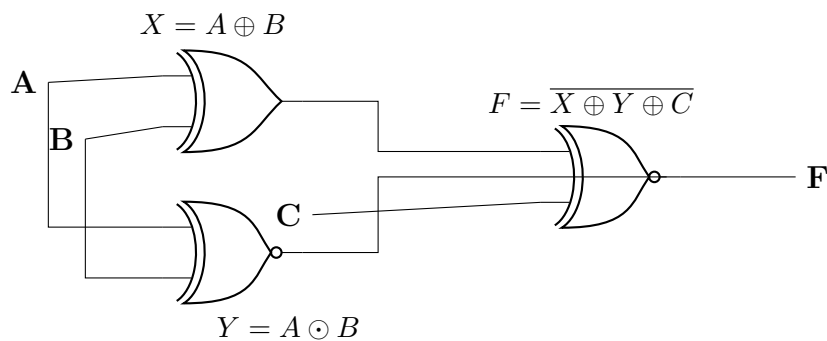
# GATE QUESTIONS

## EC PAPER - 2010

MAHALAKSHMI. I. SUNKAD  
COMETFWC012

**Q.12)** For the output F to be 1 in the logic circuit shown, the input combination should be:

**Logic Circuit Diagram**



- (A)  $A = 1, B = 1, C = 0$
- (B)  $A = 1, B = 0, C = 0$
- (C)  $A = 0, B = 1, C = 0$
- (D)  $A = 0, B = 0, C = 1$

## Solution

**Step 1: Understanding the Logic Circuit**

The circuit consists of:

1. First Gate (XOR)

- Inputs:  $A, B$
- Output:  $X$

2. Second Gate (XNOR)

- Inputs:  $A, B$

- Output:  $Y$

### 3. Third Gate (3-input XNOR)

- Inputs:  $X, Y, C$
- Output:  $F$

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## Step 2: Deriving Boolean Expressions

### 1. First XOR Gate:

$$X = A \oplus B = A\bar{B} + \bar{A}B$$

### 2. Second XNOR Gate:

$$Y = A \odot B = AB + \bar{A}\bar{B}$$

### 3. Third XNOR Gate (3-input XNOR):

$$F = X \odot Y \odot C$$

$$F = \overline{X \oplus Y \oplus C}$$

$$F = \overline{(A \oplus B) \oplus (A \odot B) \oplus C}$$

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## Step 3: Constructing the Truth Table

A	B	C	X (XOR)	Y (XNOR)	F (3-input XNOR)
0	0	0	0	1	1
0	0	1	0	1	0
0	1	0	1	0	1
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	1	0	0
1	1	0	0	1	1
1	1	1	0	1	0

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## Step 4: Finding the Correct Answer

For  $F = 1$ , the valid input combination is:

$$(0, 0, 1)$$

Comparing with given options:

- (A)  $A = 1, B = 1, C = 0$
- (B)  $A = 1, B = 0, C = 0$
- (C)  $A = 0, B = 1, C = 0$
- (D)  $A = 0, B = 0, C = 1$  (Correct)

**Final Answer:**

Option (D):  $A = 0, B = 0, C = 1$