## **Experiment (1)**

# AND-OR-INVERTER (A-O-I) Gate Circuit

#### **Objective:**

Understanding the basic principles of combined logic.

#### **Introduction:**

AND-OR-INVERTER (A-O-I) gates consist of two **AND** gates, one **OR** gate and one Inverter (NOT) Gate.

 $A \circ \bigcirc B \circ \bigcirc F = \begin{bmatrix} A & \bigcirc & & & & \\ A \circ & & & & \\ B \circ & & & & \\ F7 \circ & O \circ & & & F1 \circ & \\ F7 \circ & O \circ & & & F1 \circ & \\ F2 \circ & & & & \\ B \circ & & & & \\ C \circ & & \\ C$ 

#### The Boolean expression for the output F4 is:

 $\mathbf{F} = \overline{\mathbf{AB} + CD} \quad \cdots \quad \mathbf{Equation (1)}$ 

Equation (1) can be converted into de Morgan's theorem as:

 $F = (\overline{A} + \overline{B}).(\overline{C} + \overline{D}) \qquad \dots \qquad Equation (2)$ 

Equation (1) is also referred to as **(Sum of Products)** Equation (2) is also referred to as **(Product of Sum)** 

## Equipments Required: Digital Logic Lab; Module KL-33002( block c )

### **Procedures:**

- 1. Connect inputs (A, A<sub>1</sub>, B, B<sub>1</sub>) to Data Switches SWo, SW<sub>1</sub>, SW<sub>2</sub>, SW<sub>3</sub> respectively and connect outputs F<sub>3</sub>, F<sub>4</sub> to logic indicators L<sub>1</sub>, L<sub>2</sub>.
- 2. Set B and B1 to '0', follow the input sequences for A and Al in Table (3-1) and record the output.
- 3. What does F3 act Between A & A1?
- 4. Set A = A1 = 0, follow the input sequences for B & B1 in Table (3-2) and record the output.

What does F3 act Between B & B1?



5. When A and  $A_1 \neq 0$ ', Does  $F_3$  act as an AND gate between B and  $B_1$ . Why?

6. Follow the following table and record the output?

Prove that F<sub>3</sub> equal to A.A1 + B.B1

A	A1	В	B1	F3
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

## Table(3-3)

7. If B = A' and B1 = A1', What do the output functions (F3 & F4) represent?

# **Discussion:**

1. What logic does the A-O-I circuit represent?

a. AND	b. NAND	c. Both			
2. What is the output of an A-O-I gate?					
a. $AB + CD$	b. (A+B).(C+D)	c. ABCD			

3. "Sum of Products" is express	ed as:	
a. $AB + CD$	b. (A+B).(C+D)	c .ABCD

4. What are the advantages of using AOI?