

# Experiment No.1

## Logic Gates

### 1. Introduction

#### 1.1 Objective:

Study the operation of all logic gates.

#### 1.2 Components:

- TESCA board 38609.
- Set of connecting wires.

#### 1.3 Theory:

There is a computer logic training board has been designed specifically to study simple Logic Functions and Theorems of Boolean Algebra and to compare the truth table with experimental results it's made by TESCA. This training board offers a method of training students in the basic theory of digital circuits and make them familiar with basic experiments in digital circuits. The board is absolutely self-contained and requires no other apparatus.

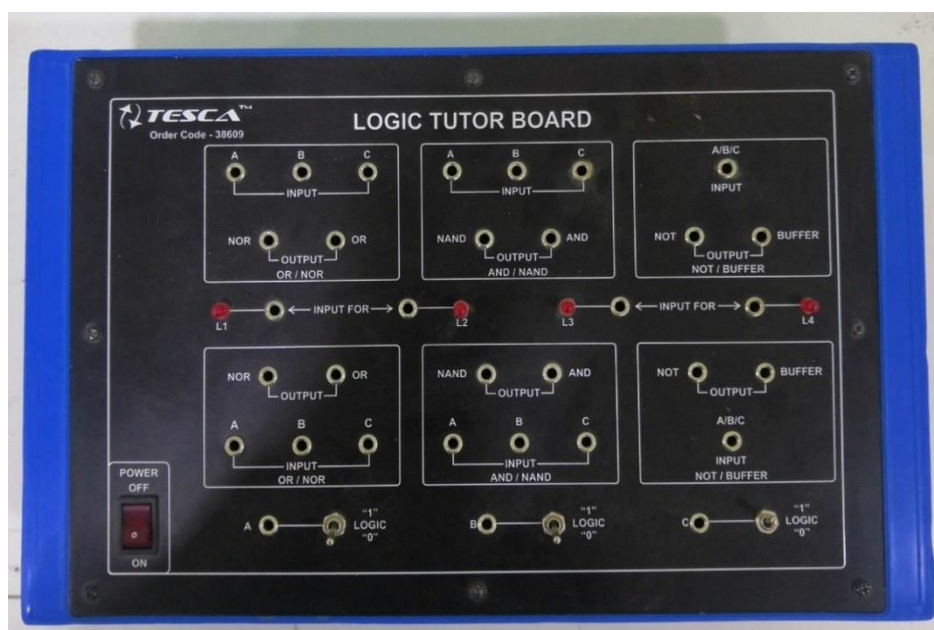


Figure 1: TESCA Board

A logic gate is an electronic circuit/device which makes the logical decisions. To arrive at this decisions, the most common logic gates used are OR, AND, NOT, NAND, and NOR gates. The NAND and NOR gates are called universal gates. The exclusive-OR gate is another logic gate which can be constructed using AND, OR and NOT gate.

Logic gates have one or more inputs and only one output. The output is active only for certain input combinations. Logic gates are the building blocks of any digital circuit. Logic gates are also called switches. With the advent of integrated circuits, switches have been replaced by TTL (Transistor-Transistor Logic) circuits and CMOS circuits.

## AND Gate

The AND gate performs logical multiplication, commonly known as AND function. It has two or more inputs and single output. The output of AND gate is HIGH only when all its inputs are HIGH (i.e. even if one input is LOW, Output will be LOW).

If X and Y are two inputs, then output F can be represented mathematically as  $F = X.Y$ , here dot (.) denotes the AND operation sometime  $X=A \& B$ . The symbol and Truth table of the AND gate are shown in the Figure (2) and Table (1) respectively.

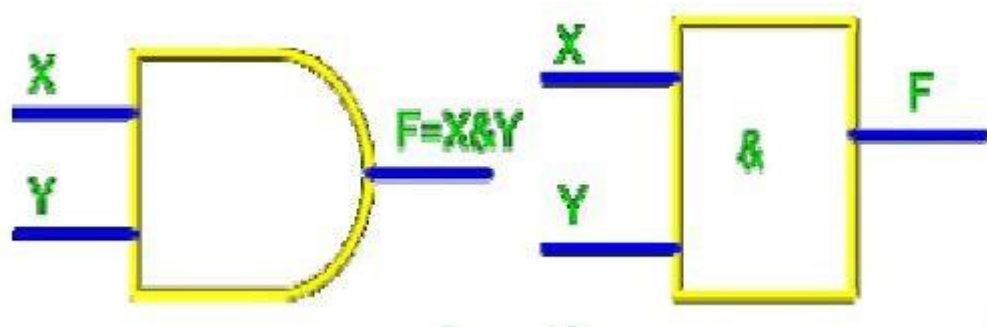
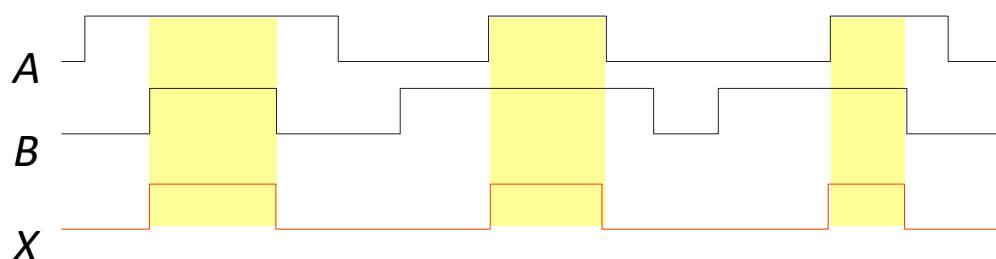


Figure 2: AND Gate Symbol

Inputs		Output
X	Y	$F = X.Y$
0	0	0
0	1	0
1	0	0
1	1	1

Table 1: Truth Table of AND Gate

### Example waveforms:



## OR Gate

The OR gate performs logical addition, commonly known as OR function. It has two or more inputs and single output. The output of OR gate is high only when any one of its inputs are high (i.e. even if one input is high, Output will be high).

If X and Y are two inputs, then output F can be represented mathematically as  $F = X + Y$ . Here plus sign (+) denotes the OR operation. The symbol and Truth table of the OR gate are shown in the Figure (3) and Table (2) respectively.

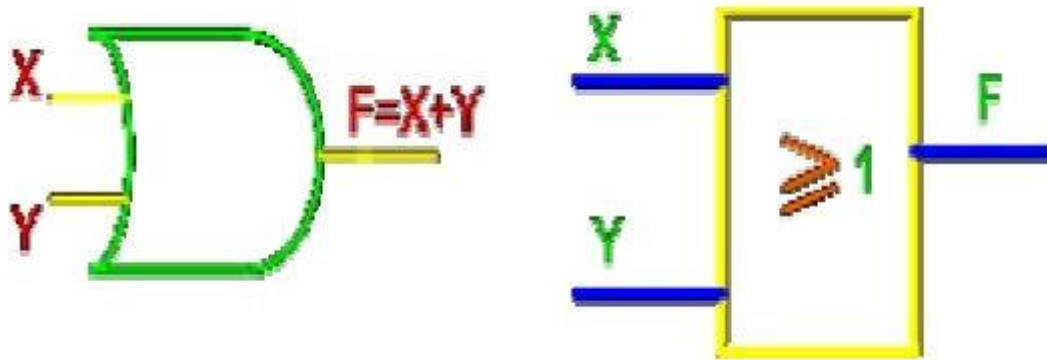
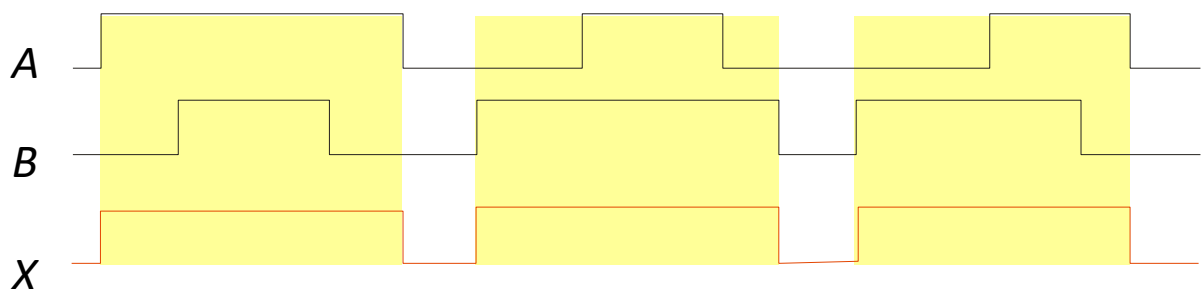


Figure 3: OR Gate Symbol

Inputs		Output
X	Y	$F = X + Y$
0	0	0
0	1	1
1	0	1
1	1	1

Table 2: Truth Table of OR Gate

### Example waveforms:



## 2. Discussion:

1. What is the truth table for the **AND** gate?
2. What is the truth table for the **OR** gate?
3. Draw the symbol of an **AND** gate and an **OR** gate.
4. What will be the output of an **AND** gate if both inputs are 1?
5. What will be the output of an **OR** gate if both inputs are 0?