Pre-Requisites Experiment

EXPERIMENT No. 1

AIM: Familiarization with Digital trainer kit & its associated components.

APPARATUS: Digital trainer kit, its associated components.

THEORY:

LOGIC GATES:

AND Gate: It has two inputs and one output. The AND operation is 1 only if all inputs are one Mathematically: (Suppose A & B are the inputs & Y is the output for all the gates)

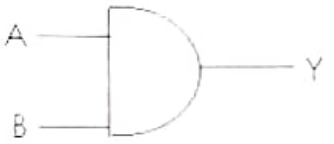

Fig 1.1: Symbol of AND Gate

$$Y = A.B$$

OR Gate: The OR operation is defined as one of one or more than one input is high; the logical equation for OR is Y = A+B.

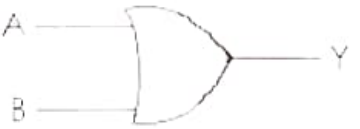

Fig 1.2: Symbol of OR Gate

NOT Gate: It is also called as inverter. It has one input and one output.

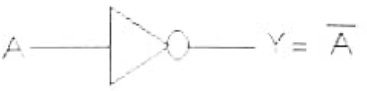

Fig 1.3: Symbol of NOT Gate

$$Y = \overline{A}$$

NAND Gate: The NOT-AND operation is known as NAND-gate operation. The operation is shown by

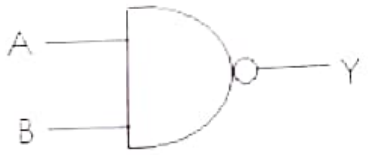

Fig 1.4: Symbol of NAND Gate

$$Y = \overline{A \cdot B}$$

NOR Gate: The NOT-OR operation is known as NOR gate operation. The equation is

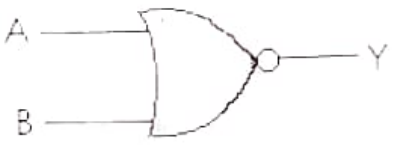

Fig 1.5: Symbol of NOR Gate

$$Y = \overline{A + B}$$

XOR Gate: The X-OR operation is not a basic operation & can be performed by using other gates. The operation is

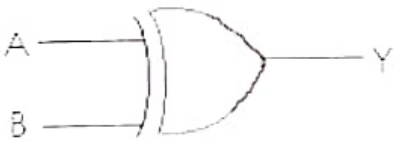

Fig 1.6: Symbol of XOR Gate

$$Y = A\overline{B} + \overline{A}B$$

X-NOR Gate: The gate is also combination of several logical gates. The operation is given as

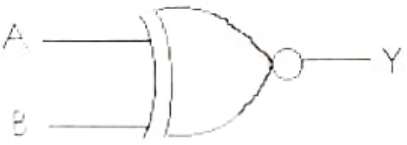

Fig 1.7: Symbol of X-NOR Gate

$$Y = AB + \overline{A}\overline{B}$$

FLIP-FLOPS:

Edge-triggered flip-flops: These are synchronous devices. The term synchronous means that the output changes its states only at specified points on the triggering input called clock. The term edge triggered means that flip-flop change only at the +ve & -ve edge.

SR-FLIP FLOP: The S R inputs of SR flip-flops are called synchronous inputs because data on these inputs are transferred & only discrete voltages are used here as logical 0 & 1.

JK- FLIP FLOP: This is very versatile & widely used flip-flop. The function is identical to that of S-R flip flop is set, reset & no change condition of operation. The difference is that J-K flip flop has no invalid state.

D-FLIP FLOP: It is useful when 0 signal data list is to be stored. The simple addition of an inverter to an S-R flip flop creates a basic D-flip-flop.

T-FLIP FLOP: In J-K F/F short circuiting of J –K terminals, resulting in T-flip flop; if T= 1, it acts as a logic switch, if T = C, the output remains same.

IC TESTER:

The front panel logout is designed keeping case of operator convenient display & pleasant look in the mind first line of front panel display. It indicates the model; no while second line display is used to interact with user key can broadly be classified into two classes. Key with marking 0,1,2,3,4,5,6,7,8,9 is known as input keys.

CRO:

It is most electrical instrument. This gives visual representation of elec. Quantities. It consists of following major parts:

1. Cathode rays' tube
2. Power supply
3. Time based circuit
4. Deflection voltage.

BCD to 7 SEGMENT DECODER:

A digital display that consists of 7-segment LED's segment is used to display decimal numerals in digital system. In the IC 7447 accepter, the binary input & convert it into 0 to 9 numbers.

INTEGRATED CIRCUITS:

The circuit in which active & passive components such as transistor diode, capacitor, resistor etc. are small pieces port. Semiconductor chips are IC's.

Classification of IC's:

1. Monolithic
2. Thin Film
3. Thick Film
4. Hybrid
5. Digital
6. SSI
7. VLSI

Linear IC's: Linear IC's process analog signals. These contain several amplifier circuits. The output varies in direct preposition to its input for IC 741. The digital IC's process digital signals & are basically pulse circuit. Hence o/p is not linear with respect to input.

MULTIMETER:

It is an electrical instrument used to measure voltage, current & resistance. So, it is called as volt-ohm meter. It consists of ordinary pivot-type moving galvanometer.

EXPERIMENT No. 2

AIM: Study and Implementation of Truth Tables of - AND, OR, NOT, NAND, NOR Gates.

APPARATUS: Logic Gate Circuit Trainer, IC used 7400, 7402, 7404, 7408, 7432, 7486, connecting wires.

THEORY: The digital circuit which either allows a signal to pass through or stop it is called gate. Gates which allow a signal to pass through only when some logical conditions are satisfied are called logic gate. Logic gates usually combine one or more logic variables input to produce and output. All of the possible combinations of the input variables and the corresponding outputs are normally listed in a table called a truth table. The simple logic gates are: (i) AND (ii) OR (iii) NOT. The compound (Universal) logic gates are (i) NAND (NOT-AND) (ii) NOR (NOT-OR)

AND Gate Using 7408: A circuit which performs an AND operation. It has N Inputs (N=2) and one output. Digital signals applied at the input terminals marked A, B. The o/p is obtained at the o/p terminal marked Y.

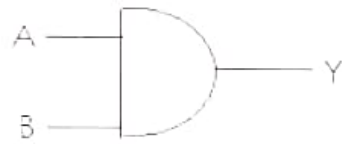

Fig 2.1: Symbol of AND Gate

Table 2.1: Truth Table of AND Gate

Inputs		**Outputs**
A	**B**	**Y**
0	0	0
0	1	0
1	0	0
1	1	1

In case of this basic gate output is present only when all the inputs are present. Its logical expression is given by Y = A. B.

OR Gate Using 7432: It allows the signal to pass through when even any one of the logical conditions is satisfied.

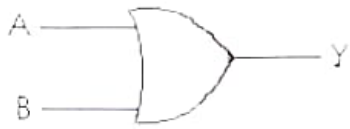

Fig 2.2: Symbol of OR Gate

Table 2.2: Truth Table of OR Gate

Inputs		**Outputs**
A	**B**	**Y**
0	0	0
0	1	1
1	0	1
1	1	1

The GATE in which output is 1 if and only one or more inputs are 1. Its logical equation is given by Y = A+B.

NOT Gate Using 7404: It allows the signal to pass through when the only logical condition is not satisfied it.

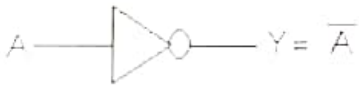

Fig 2.3: Symbol of NOT Gate

Table 2.3: Truth Table of NOT Gate

Input	Output
A	Y
0	1
1	0

It is also known as inverter. It has one input (A) and one output (Y). Its logical equation is $Y = \overline{A}$.

NAND Gate Using 7400: It combines characteristics of a NOT and an AND gate. The NOT-AND operation is known as NAND operation. A bubble on the output side of NAND gate represents NOT operation, inversion or complementation. Its logical equation is $Y = \overline{A \cdot B}$.

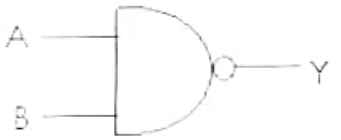

Fig 2.4: Symbol of NAND Gate

Table 2.4: Truth Table of NAND Gate

Inputs		Outputs
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

A NAND gate is a universal gate. It serves as a building block for AND, OR and NOT gates.

NOR Gate Using 7402: It combines characteristics of a NOT and on OR gate. The NOT-OR operation is known as NOR operation.

Fig 2.5: Symbol of NOR Gate

Table 2.5: Truth Table of NOR Gate

Inputs		**Outputs**
A	**B**	**Y**
0	0	1
0	1	0
1	0	0
1	1	0

Similar to NAND gate, a bubble on the output side of the NOR gate represents the NOT operation. The logic equation is $Y = \overline{A + B}$.

PIN DESCRIPTION:

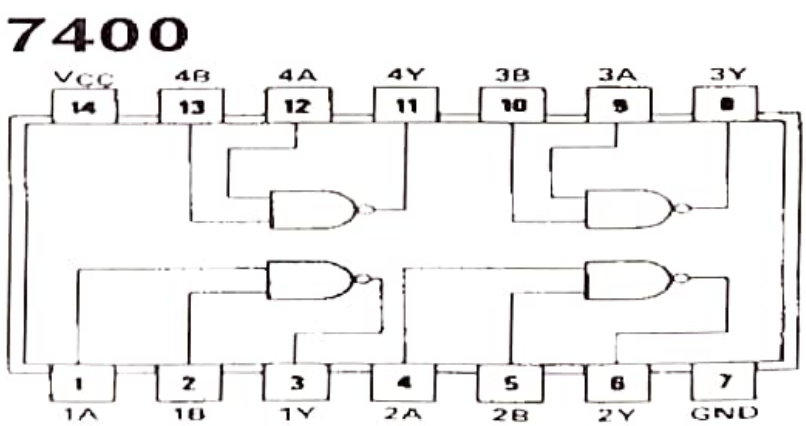

Fig 2.6: IC 7400 (NAND GATE)

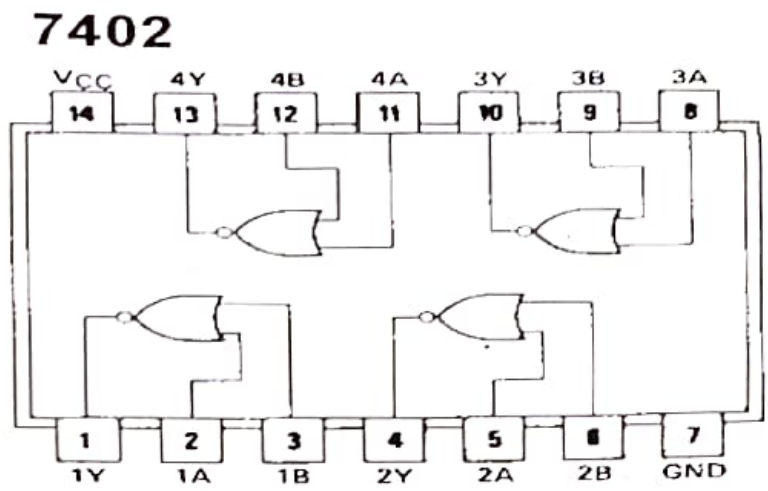

Fig 2.7: IC 7402 (NOR GATE)

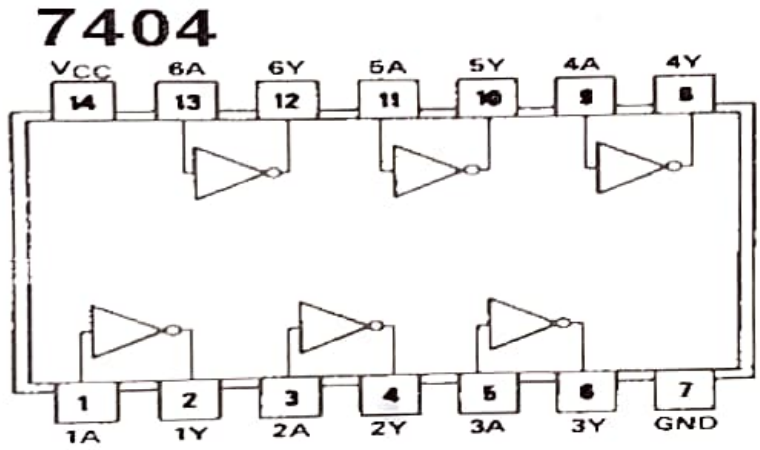

Fig 2.8: IC 7404 (NOT GATE)

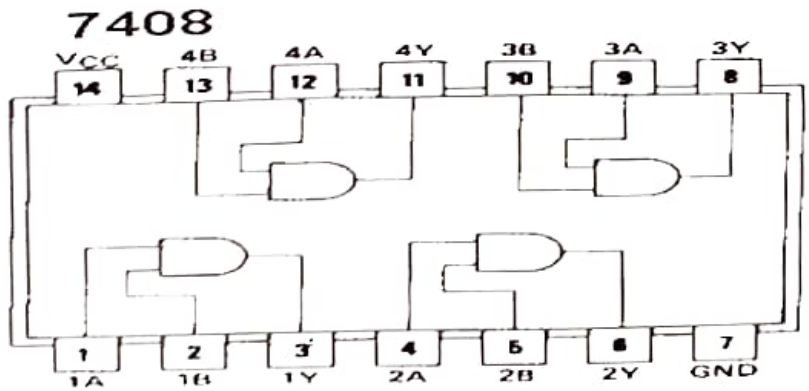

Fig 2.9: IC 7408 (AND GATE)

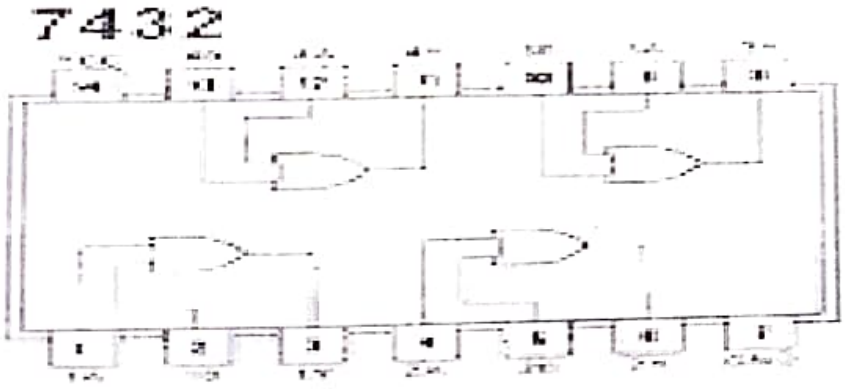

Fig 2.10: IC 7432 (OR GATE)

PROCEDURE:

1. Take the IC's numbered 7408, 7432, 7486.
2. Place them properly on their respective places.
3. Make the connections as per the circuit diagram.
4. The circuit can be verified using various values of inputs and then testing the values of output as per truth table.

PRECAUTIONS:

1. Circuit should be properly connected.
2. Do not short circuit in the trainer kit during operation.
3. Wires should be held by their heads while being removed else they may get damage.