EXPANSION OF LOGIC GATES USING TRAINER

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Abstract - *Logic gates circuit trainer offers a unique entry into the world of digital electronics. The system combines simple, convenient to use, ICs for various gates and flip-flops, power supply, clock input and output state with a versatile solderless bread board area. Students who are new to digital electronics can implement logic circuits in a matter of minutes on the bread board area. The trainer is designed in such a way that for performing any experiment, students have to connect the links by patch cords, so it is very helpful for students to learn the inputs and outputs of different logic gates. Attractive input and output sections are provided on trainer in such a manner so that multiple experiments can be performed simultaneously.*

There are many important features of the logic trainer, along with its ease of use and robustness, makes it the first choice for those wishing to introduce learners to digital electronics /logic gates for the first time.

Key Words*:* ICs, Bread Board Area, Logic Gates, Patch Cords, Trainer

1. INTRODUCTION

A logic gate is the building block of a digital circuit. Most of the logic gates have 2 inputs and 1 output which are based on Boolean algebra. At any given moment, every terminal is in one of the two binary conditions false (high) or true (low). False represents 0, and true represents 1. Depending on the type of logic gate being used and the combination of inputs, the binary output will differ. A logic gate can be thought of like a light switch, wherein one position the output is off—0 (false), and in another, it is on—1(True). Logic gates are commonly used in integrated circuits (IC). For this purpose, we use different kinds of Trainer /circuit boards.

1.1 TRAINER

Trainer are basically used for studying various types of logic gates. Most of the trainers have all the basic 7 gates, i.e. AND, OR GATE, NAND, etc.

Using virtual environment, and hardware devices the logic gates are inputted and the output is shown on the monitor screen. For this purpose we use the below IC Board for experimenting with different gates.

1.2 EXPANSION OF LOGIC GATES USING TRAINER

The expansion of logic gates is done using a trainer. The trainer we have designed has specific functioning, like it turns on red light when it is on. The green light signifies the circuit is off. A PCB (printed circuit board) has been used for logic gates. A step down transformer (0-9 v) has been used for converting the ac into dc (Fig-2). We have also used a full wave rectifier.

2. DC supply

A regulated power supply is essential for many electronic devices due to the material of semiconductor employed in them. It has a fixed rate of current as well as voltage. The device has chances of getting damaged if there is any deviation from the fixed rate.

One of the important sources of DC Supply are Batteries. But using these batteries in sensitive circuits is not a good idea as batteries will eventually drain out and lose their potential over time.

Also, the voltage provided by batteries are typically 1.2V, 3.7V, and 9V and so on. This thing is good for circuits whose voltage requirements are in that range. But, most of the TTL IC's works on 5V logic and hence we need a mechanism to provide a proper and consistent 5V Supply.

Here comes the 7805 Voltage Regulator IC to prevent. It is an IC in the 78XX family of linear voltage reg**ulators that produces a regulated 5V as output**

Basic Circuit of 7805

As previously mentioned about regulated power supply as a device that works on DC voltages and it can uphold its output accurately at a fixed voltage all the time even if there is a significant alteration in the DC input voltage.

According to the datasheets of 7805 IC, the basic circuit required for 7805 to work as a complete regulator is extremely simple. In fact, if the input supply is an unregulated DC Voltage, in that case all you need are two capacitor (even those are not mandatory depending on the implementation).

Fig -1: IC circuit

The circuit show above has all the components required for a 7805 IC to work properly. The Capacitor (0.22µF) near the input is required only if the distance between the regulator IC and the power supply filter is high. Additionally, the 0.1µF Capacitor near the output is optional and if it is used, it helps in the transient response.

In this given circuit, VIN is the input voltage to 7805 IC and the source can be from a battery of an unregulated DC. VOUT is the output of this circuit, which is a Regulated 5V.
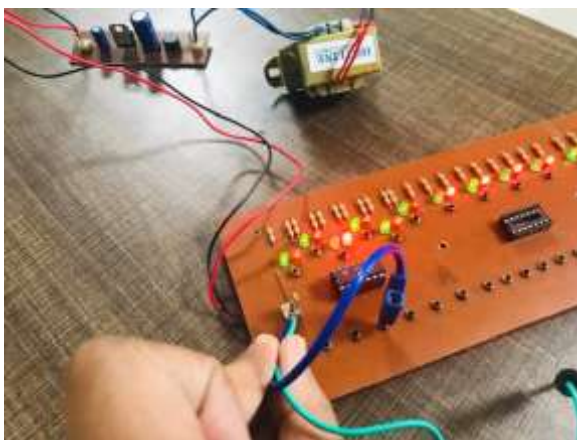

Fig -2: Bread Board

A Brief Note on 7805 Voltage Regulator

7805 is a 3 terminal linear voltage regulator IC which has a fixed output voltage of 5V, which is further useful and plays an important role in a wide range of applications. Presently, the 7805 Voltage Regulator IC is manufactured by Texas (America)   Instruments, ON Semiconductor, STMicroelectronics, Diodes incorporated, etc.

Some of the important features of the 7805 IC are as follows:

- It can deliver up to 1.5 A of current (with heat sink).

- Has both internal current limiting and thermal shutdown features.

- Requires very minimum external components to fully function.

Pin Diagram of 7805 Voltage Regulator IC

As Explained earlier, 7805 is a three terminal device which has three pins being 1. INPUT, 2. GROUND and 3. OUTPUT.

If you observe, the working of the circuit can be divided into two parts. In the first part, the AC Mains is converted into unregulated DC and in the second part, this unregulated DC is converted into regulated 5V DC. So, let us start discussing the working with this in mind.

At Initial level, a 230V to 12V Step down transformer is usually taken. Its primary is connected to mains supply. The secondary of the transformer is made to connect to Bridge rectifier (either IC or a combination of 4 1N4007 Diodes can be made to use).

A 1A fuse is usually placed between the transformer and the bridge rectifier. This will help to limit the current drawn by the circuit to atleast by 1A. The rectified DC from the bridge

Rectifier is smoothened out with the help of a capacitor of 1000µF Capacitor.

Because of the above scenario, the output across the 1000µF Capacitor is unregulated 12V DC. This is further given as an input to the 7805 Voltage Regulator IC. The IC (7805 IC) converts this to a regulated voltage of 5V DC and then the output can be obtained at its output terminals.

The description of the pin of the 7805 is described in the following table:

PIN NO.	PIN	DESCRIPTION
1	INPUT	Pin 1 is the INPUT Pin. A positive unregulated voltage is given as input to this pin.
2	GROUND	Pin 2 is the GROUND Pin. It is common to both Input and Output.

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3. CONCLUSION

People who are new to digital electronics can implement logic circuits in a matter of seconds on the bread board area. The trainer is designed in such a way that helps in performing any experiment. Learners have to connect the links by patch cords, so it is very helpful for students to learn the inputs and outputs of different logic gates. Easy to point out input and output sections are provided on trainer in such a manner so that multiple experiments can be performed.

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