

Experiment No. 1

Familiarization of Hardware setup

Run 1: Understanding the trainer board (20 mins)

The power supply is a source of regulated DC power. It is used to power different ICs. It is also used to provide logic level inputs to different digital circuits. Below are the tasks to perform:

- (a) Connection of inputs to output LEDs
- (b) Manual clock to LEDs

Q: Why is it called multi-output supply?

A: Because it has positive, negative and 5V supply possible.

Q: Which amongst the outputs of the power supply would you choose for digital IC based experiments? Why?

A: 5V would be used because anything above the IC will burn

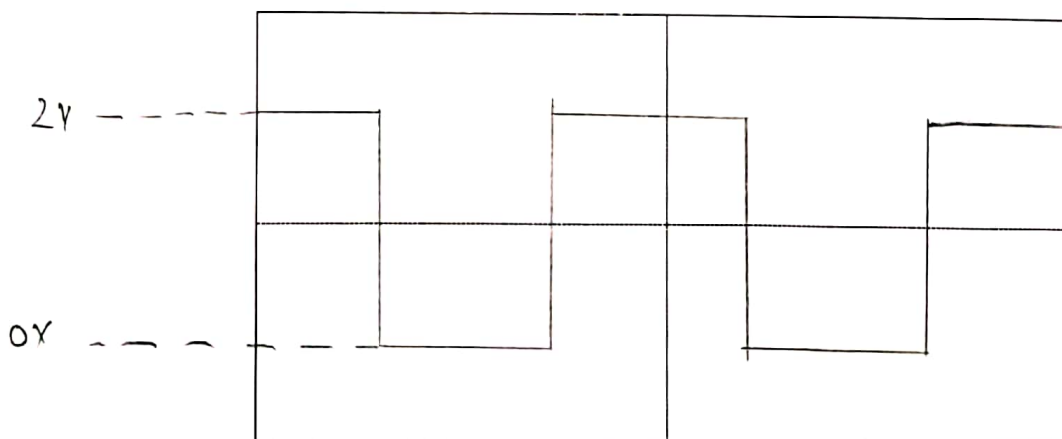
Run 2: Understanding the CRO (20 Mins)

The CRO is the most useful and versatile electronic test equipment. It lets us see voltage in a circuit as a function of time, triggering on a particular point of the waveform so that a stationary display result. Below are the tasks to perform:

- (a) Connect and see the test square waveform from CRO itself
- (b) Connect and see the square wave from trainer board to CRO (vary frequency)

Q: Draw the test square waveform generate by CRO itself. What is the voltage and frequency of this waveform?

A:



$$\text{Voltage} = 2 \times 1 = 2V$$

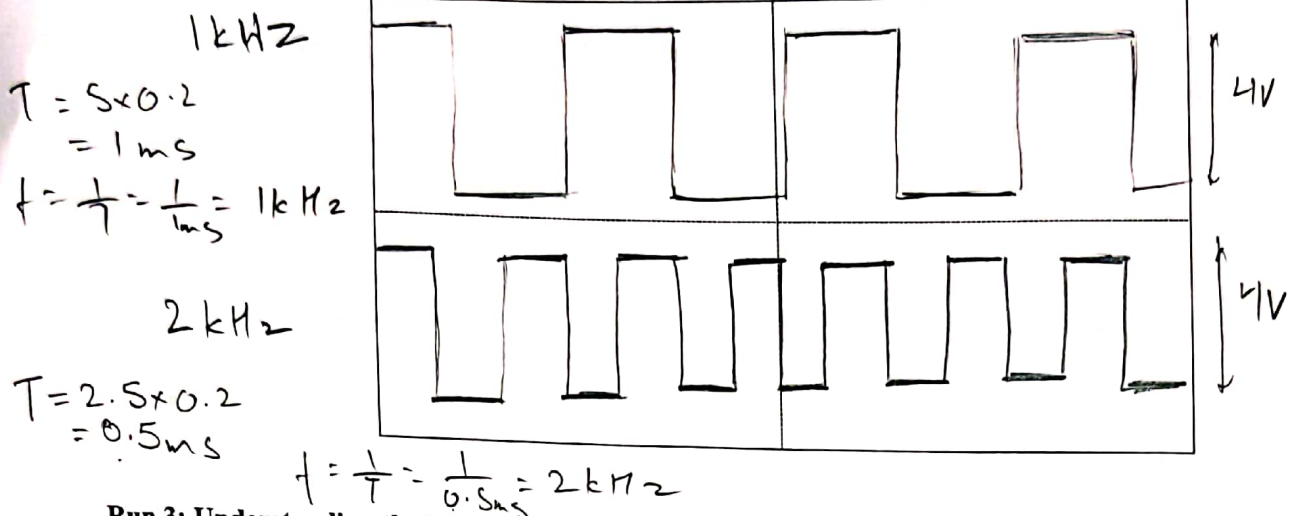
$$\text{Frequency} = \frac{1}{0.5 \times 2} = 1 \text{ kHz}$$

$$\text{Voltage} = \text{No of div in y axis} \times \frac{\text{Volts}}{\text{Div}}$$

$$\text{Frequency} = \frac{1}{T} \text{ ; } T = \text{No. of div in x axis} \times \frac{\text{Time}}{\text{Div}}$$

Q: Generate a square wave of 5 V from TTL O/P of Function Generator, 1KHz from trainer board to CRO. Calculate time period and Draw the waveform? Draw another wave form with 2KHz frequency.

A:



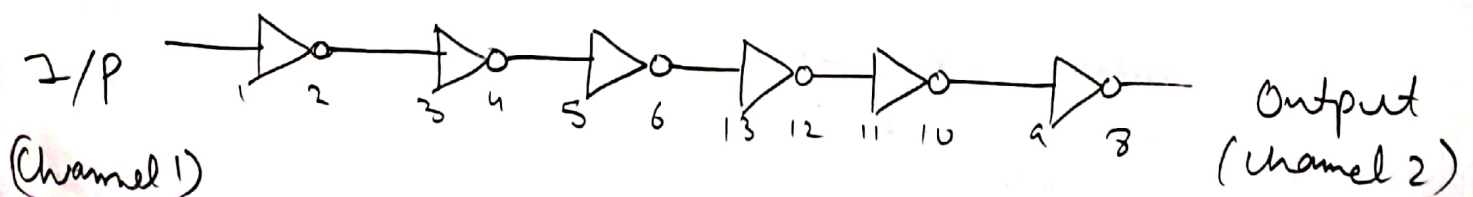
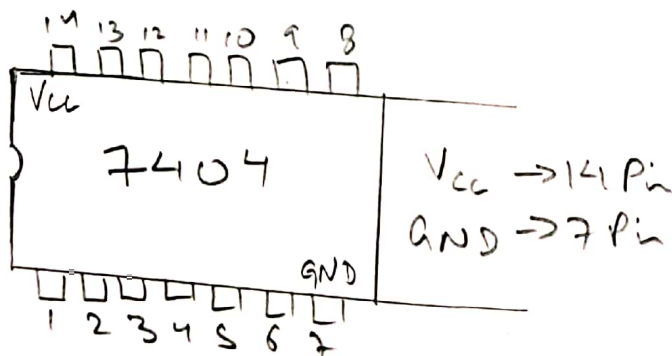
Run 3: Understanding the IC data sheet of NOT Gate (20 mins)

Refer Appendix-II for IC Data Sheet

- Pin Diagram
- Voltage nominal +/- tolerance
- Logic low range
- Logic high range
- Gate delay

Q: Write is the IC no. of NOT Gate? Draw its Pin Diagram?

A: IC 7404



Q: How much voltage is required to operate an IC and write the voltage tolerance?

A: 5V is required to operate
The tolerance is $\pm 5V$

Q: Why we connect VCC and Ground?

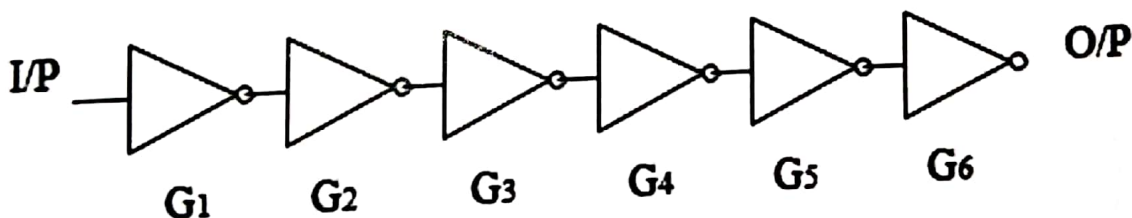
A: V_{cc} is the power supply. Ground is the ref point against which the V_{cc} is compared. V_{cc} is the higher voltage with respect to ground which activates the IC

Q: This IC is belonging to which family and What is the Logical low and high range of it?

A: IC belongs to TTL family
Logical low is 0V and high range is 5V

Run 4: Propagation delay of gates using NOT Gate (40 mins)

- Define propagation delay.
- Connect the six not gates of IC 7404 in cascade as shown below
- Apply clock pulses to the input and observe it on X channel (CH1) of CRO.
- Observe the output of the last gate on the Y channel (CH2).
- Note down t_{PHL} and t_{PLH} .



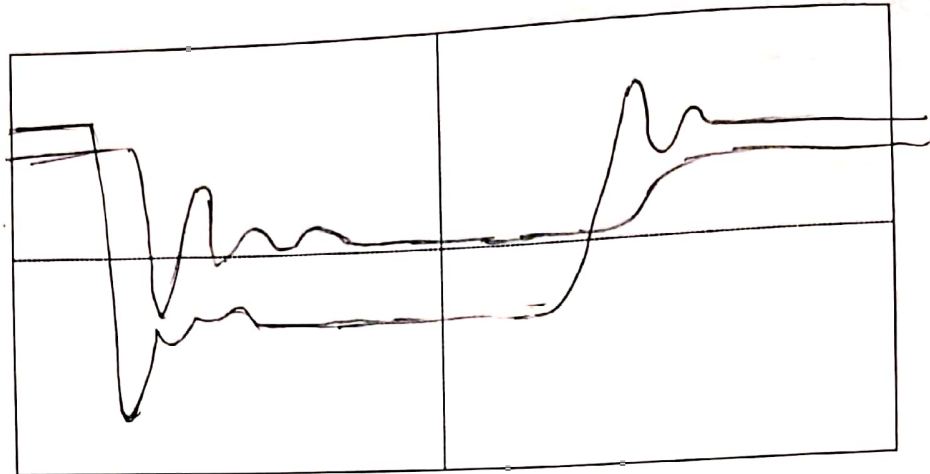
Q: Define Propagation delay time?

A: Length of time taken by a signal to reach its destination. Starts when the input to a logic gate becomes stable and valid to change, to the time that the output of that logic gate is stable and valid to change.

Q: Draw the I/P and O/P wave form.

A:

Input and output:



Q: Note down the t_{PHL} and t_{PLH} and calculate the propagation delay of each gate?

A:

Input clock frequency:

$$t_{PHL}: 0.24 \times 0.1 \mu s = 0.024 \mu s$$

$$t_{PLH}: 0.4 \times 0.1 \mu s$$

$$\text{Average propagation delay (P.D)} = (t_{PHL} + t_{PLH})/2 = 0.35 \times 0.1 \mu s$$

$$\text{Delay per gate} = \text{P.D}/6 = 0.0058 \mu s$$

Assignment:

1. How do you test if a CRO is working or not?
2. What is the meaning of the following IC packages type –SOIC and PDIP?

Test yourself

1. What is a sweep signal in a CRO and how is it relevant in triggering?
2. Where is a component tester located in the CRO and what are its applications?
3. What is significance of the ac/dc switch in the CRO?
4. What is the use of an external trigger in a pulse generator?
5. What is the cable that you use for connecting the CRO to signal point called?
6. What is the connector between the cable and the CRO called?