# Walchand College of Engineering, Sangli
## (An Autonomous Institute)



**Academic Documents for**
**FY B. Tech. (Electrical/Civil Engineering)**

**LAB MANUAL: 4EN151 Basic Electronics Lab**

## SYLLABUS

1. Design and implementation of Adders and Subtractors using logic gates.

2. Design and implementation of code converters using logic gates

     (i)  BCD to excess-3 code and vice versa

     (ii) Binary to gray and vice-versa

3. Design and implementation of 4-bit binary Adder/ subtractor and BCD adder using IC 7483

4. Design and implementation of 2Bit Magnitude Comparator using logic gates 8 Bit Magnitude Comparator using IC 7485

5. Design and implementation of 16 bit odd/even parity checker /generator using IC74180.

6. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC74150 and IC 74154

7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147

8. Construction and verification of 4-bit ripple counter and Mod-10 / Mod-12 Ripple counters

9. Design and implementation of 3-bit synchronous up/down counter

10. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.

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| EXP. NO | DATE | NAME OF THE EXPERIMENT | PG. NO | MARKS | SIGNATURE |
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| Do's | Don'ts |
|---|---|
| 1. Be Regular in Class & Lab | |
| 2. Maintain Silence in Class & Lab | |
| 3. Know the Theory behind experiment before coming Lab. | |
| 4. Identify the different leads, the terminal of trainer kits and IC Pins before making connections. | |

# The Breadboard:

The breadboard consists of two terminal strips and two bus strips (often broken in the center). Each bus strip has two rows of contacts. Each of the two rows of contacts is a node. That is, each contact along a row on a bus strip is connected together (inside the breadboard). Bus strips are used primarily for power supply connections but are also used for any node requiring a large number of connections. Each terminal strip has 60 rows and 5 columns of contacts on each side of the center gap. Each row of 5 contacts is a node.

You will build your circuits on the terminal strips by inserting the leads of circuit components into the contact receptacles and making connections with 22-26 gauge wire. There are wire cutter/strippers and a spool of wire in the lab. It is a good practice to wire +5V and 0V power supply connections to separate bus strips.
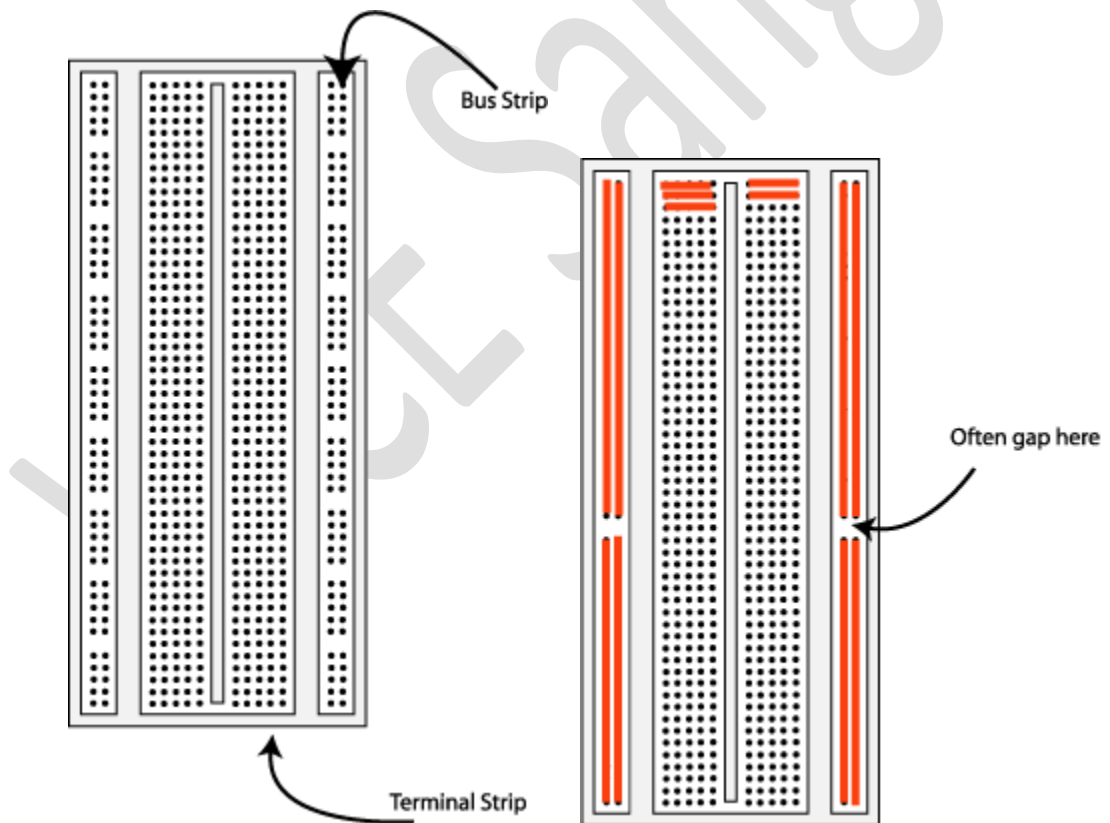


**Fig 1.** The Breadboard, the lines indicate connected holes.

The 5V supply **MUST NOT BE EXCEEDED** since this will damage the ICs (Integrated circuits) used during the experiments. Incorrect connection of power to the ICs could result in them exploding or becoming very hot - with the **possible serious injury occurring to the people working on the experiment! Ensure that the power supply polarity and all components and connections are correct before switching on the power.**

## Building the Circuit

Throughout these experiments, we will use TTL chips to build circuits. The steps for wiring a circuit should be completed in the order described below:

1. Turn the power (Trainer Kit) off before you build anything!
2. Make sure the power is off before you build anything!
3. Connect the +5V and ground (GND) leads to the power supply to the power and ground bus strips on your breadboard.
4. Plug the chips you will be using into the breadboard. Point all the chips in the same direction with pin 1 at the upper-left corner. (Pin 1 is often identified by a dot or a notch next to it on the chip package)
5. Connect +5V and GND pins of each chip to the power and ground bus strips on the breadboard.
6. Select a connection on your schematic and place a piece of hookup wire between corresponding pins of the chips on your breadboard. It is better to make the short connections before the longer ones. Mark each connection on your schematic as you go, so as not to try to make the same connection again at a later stage.
7. Get one of your group members to check the connections, **before you turn the power on**.
8. If an error is made and is not spotted before you turn the power on. Turn the power off immediately before you begin to rewire the circuit.
9. At the end of the laboratory session, collect you hook-up wires, chips, and all equipment and return them to the demonstrator.
10. Tidy the area that you were working in and leave it in the same condition as it was before you started.

**Common Causes of Problems**

1. Not connecting the ground and/or power pins for all chips.
2. Not turning on the power supply before checking the operation of the circuit.
3. Leaving out wires.
4. Plugging wires into the wrong holes.
5. Driving a single gate input with the outputs of two or more gates
6. Modifying the circuit with the power on.

In all experiments, you will be expected to obtain all instruments, leads, components at the start of the experiment and return them to their proper place after you have finished the experiment. Please inform the demonstrator or technician if you locate faulty equipment. If you damage a chip, inform a demonstrator, don't put it back in the box of chips for somebody else to use.

If you locate any errors in this manual, please e-mail:-

**Sunil.kore@walchandsangli.ac.in**

**Example Implementation of a Logic Circuit**

Build a circuit to implement the Boolean function F = /(/A./B), please note that the notation **/A** refers to $\overline{A}$. You should use that notation during the write-up of your laboratory experiments.
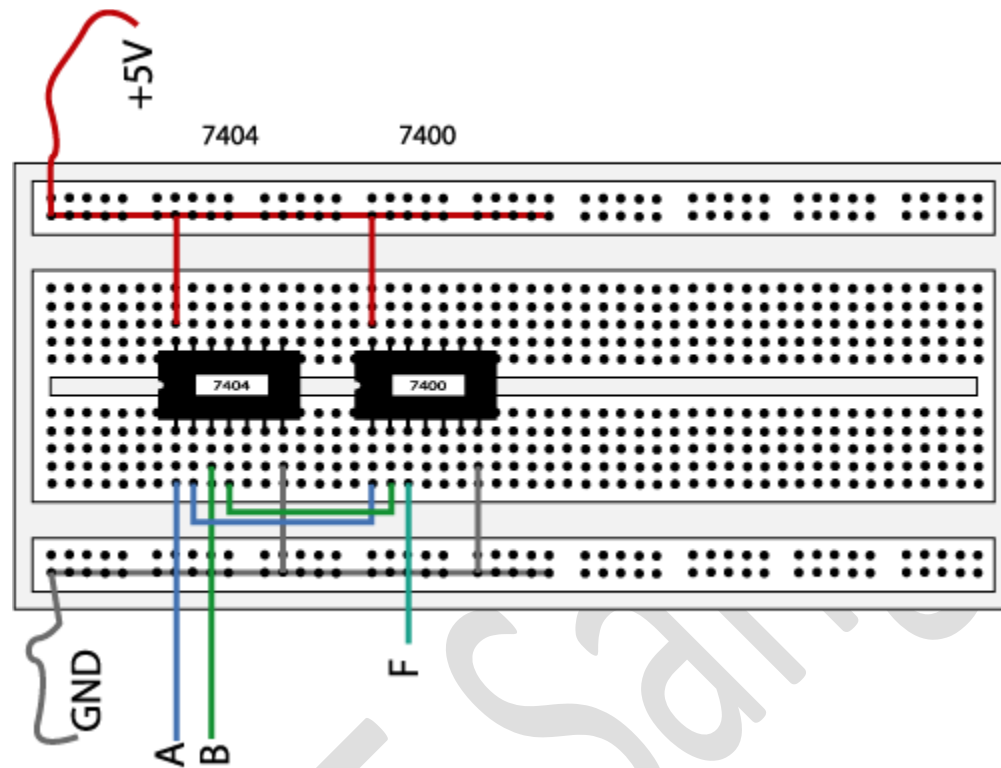
Quad 2 Input 7400                    Hex 7404 Inverter



**Fig 2.** The complete designed and connected circuit

Sometimes the chip manufacturer may denote the first pin by a small indented circle above the first pin of the chip. Place your chips in the same direction, to save confusion at a later stage. Remember that you must connect power to the chips to get them to work.

7400 Quad 2 input
NAND Gates

7402 Quad 2 input
NOR Gates

7404 Hex NOT Gates
(Inverters)

7408 Quad 2 input
AND Gates

7432 Quad 2 input
OR Gates

7486 Quad 2 input
XOR Gates

7485
4-Bit Magnitude Comparator

747266 Quad 2 input
XNOR Gates