# DIGITAL ELECTRONICS LAB MANUAL

**NAME USAMA ATTA ABBASI**
**ROLL NO 20ES070**
**BATCH 20 ES**
**DEPARTMENT OF ELECTRONIC ENGG.**

PREPARED BY:

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# List Of Experiments

1. Arithmetic Circuit- construction and testing of
   a. Half adder and Full adder.
   **b.** Half subtractor and Full subtractor.

2. Combinational logic circuit design using 74xxICs.

3. Encoders and Decoders.

4. Multiplexer and Demultiplexer.

5. Study of Arithmetic Logic Unit(ALU) using IC 74181.

6. Construction of 1- bit comparator using 74xxICs and study of 4-bit comparator IC 7485.

7. code converters – Binary to gray and Gray to binary.

8. Verification of basic flip flops using 74xxICs and master-slave JK flip-flop using IC 7476

9. Asynchronous counter design and Mod-n counter.

10. 3-Bit synchronous counter design

11. Shift register- SIPO/SISO & PISO/PIPO.

12. Study of RAM.

## The Laboratory Notebook:

Each student must have their own laboratory notebook. All pre-lab exercises and laboratory reports are to be entered into your notebook.

Your notebook must be clearly labelled on the cover with the following information:

**Module:** Digital Electronics -
**Name: USAMA ATTA ABBASI**
**Roll no: 20ES070**
**Class: DIGITAL ELECTRONICS LAB**
**Lab Group: 1**

# Introduction

There are 3 hours  allocated to a laboratory session in Digital Electronics. It is a necessary part of the course at which attendance is compulsory.

Here are some guidelines to help you perform the experiments and to submit the reports:

1. Read all instructions carefully and carry them all out.
2. Ask a lab person if you are unsure of anything.
3. Record actual results (comment on them if they are unexpected!)
4. Write up full and suitable conclusions for each experiment.
5. If you have any doubt about the safety of any procedure, contact the lab supervisor beforehand.
6. **THINK** about what you are doing!

# The Breadboard

The breadboard consists of two terminal strips and two bus strips (often broken in the centre). Each bus strip has two rows of contacts. Each of the two rows of contacts are 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 centre 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.

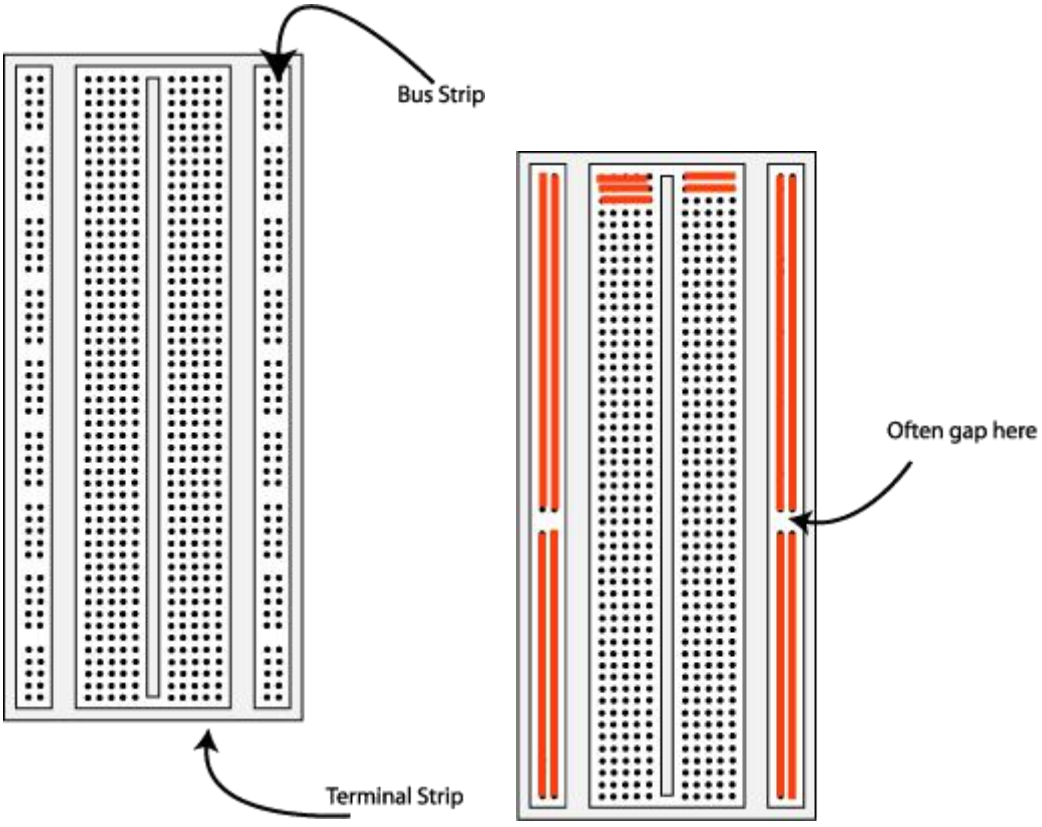



**Fig 1.** The breadboard. The  lines indicate connected holes.

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 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 of 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 hook-up 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.

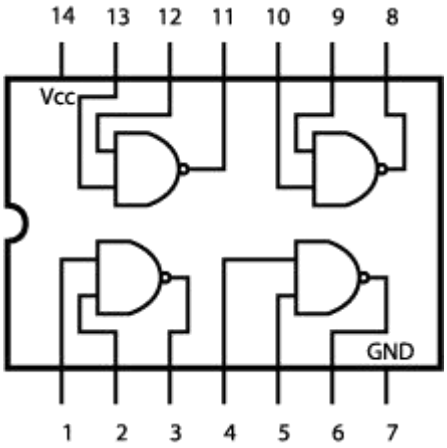
## Common Causes of Problems

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.

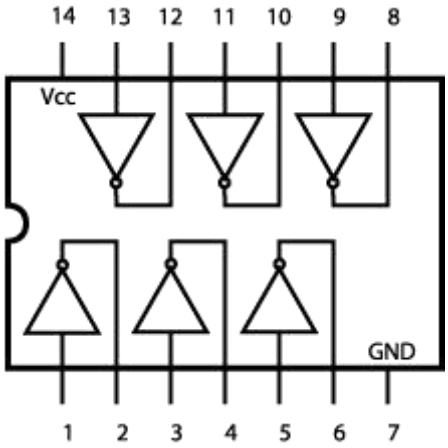
In all experiments, you will be expected to obtain all instruments, leads, components at the start of the experiment and return them to their proper place after you have finished the experiment. Please inform the demonstrator or technician if you locate faulty equipment. If you damage a chip, inform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

## 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

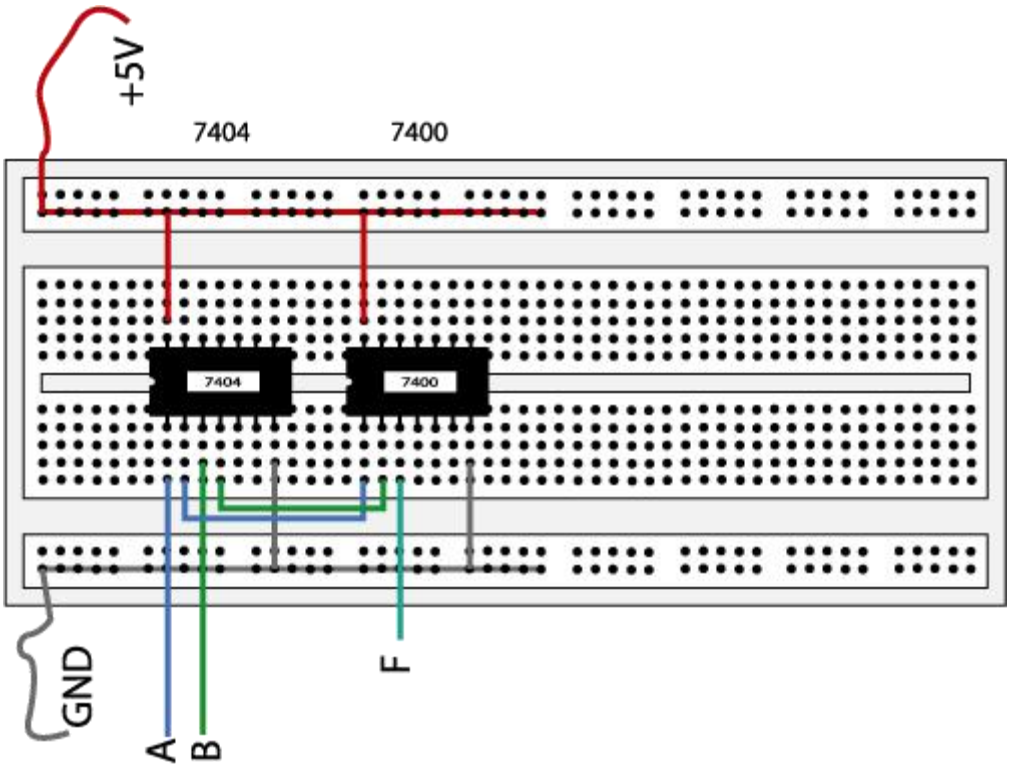
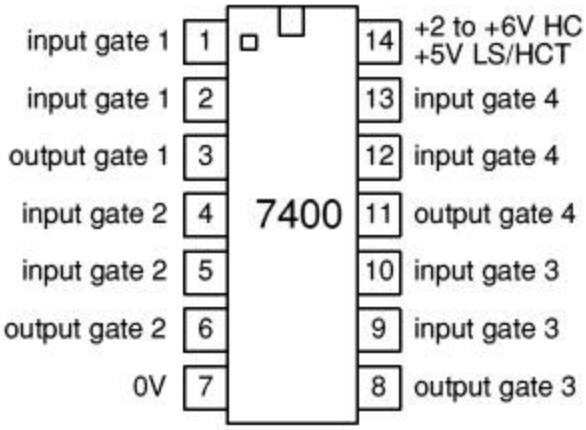



**Fig 2.** The complete designed and connected circuit

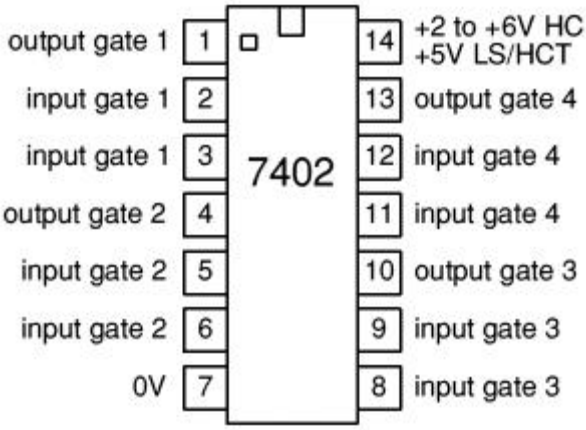
Sometimes the chip manufacturer may denote the first pin by a small indented circle above the first pin of the chip. Place your chips in the same direction, to save confusion at a later stage. Remember that you must connect power to the chips to get them to work.

# Useful IC Pin details

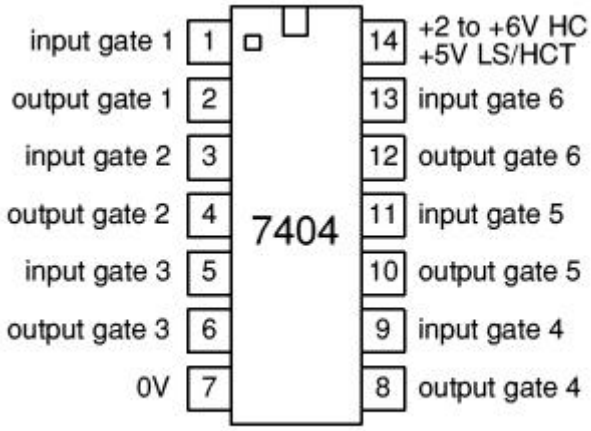
## 7400(NAND)



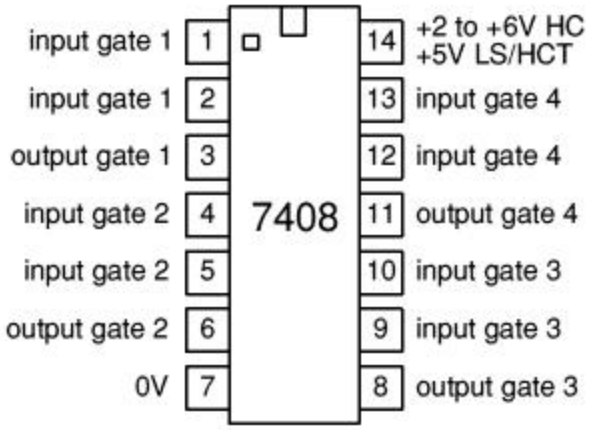

7402(NOR)



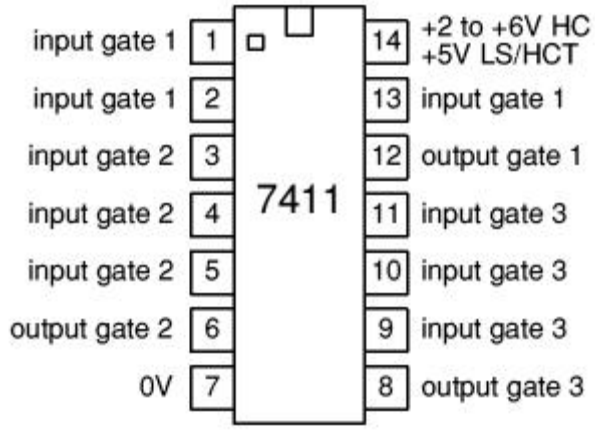
7404(NOT)



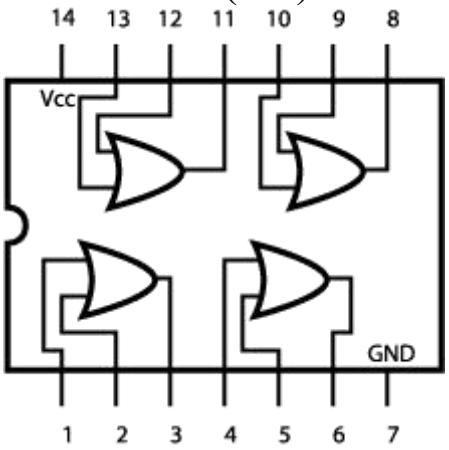

7408(AND)



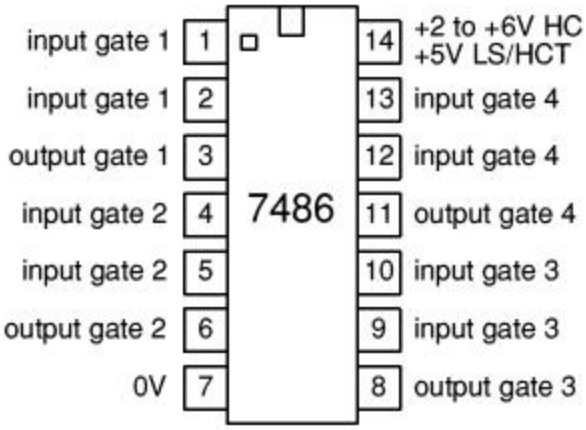

7411(3-i/p AND)

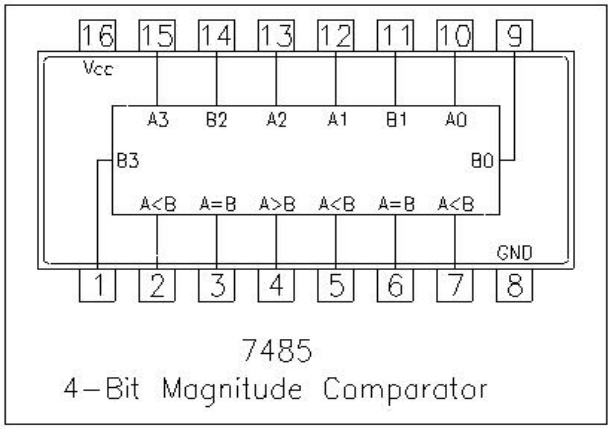


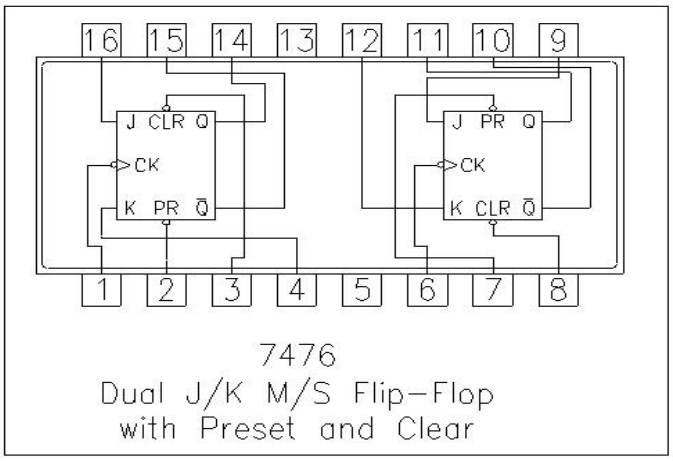
7432(OR)



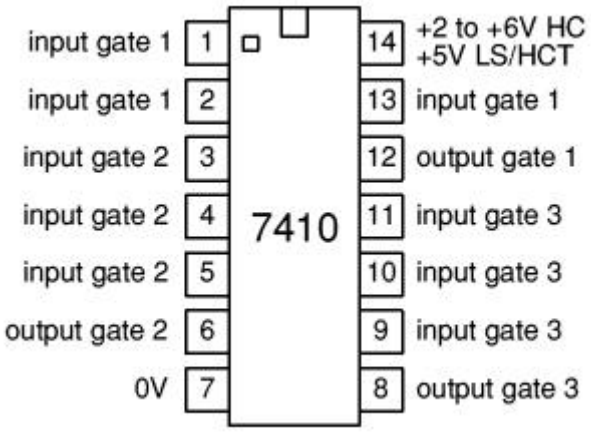

7486(EX-OR)






7410(3-i/p NAND)




7420(4-i/p NAND)