Practice 1

BASIC CONCEPTS.
INTRODUCTION TO THE USE OF EQUIPMENT

Objectives:

The aim of this practice is that the students have a first contact with the lab and become familiar with the management of the basic instrumentation.

FIRST PART

Verification of the truth table of a NAND gate

Duration of practice: 2 hours

Instrumentation in the lab
- Power supply
- Digital multimeter
- Connectors

Material the student must bring

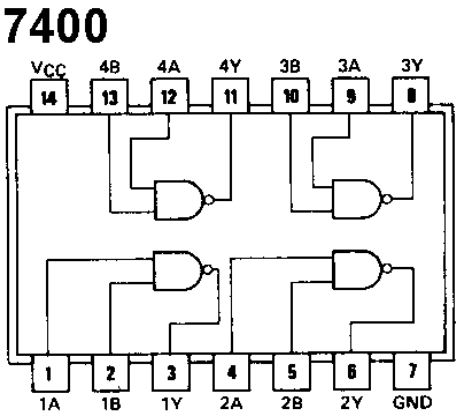
Common to all practices

The equipment needed (**per pair**) will be:
• Breadboard (placa de inserción)
• flat nose pliers (alicates de punta plana)
• Wire stripper, scissors (Electrician), wire cutters or similar (pelacables,, tijeras de elecrtricista)
• Small screwdriver (destornillador pequeño)
• Thin wire to connect components (without threads and rigid with the thickness suitable for insertion). (cable para conexión)

Specific to this practice

• Integrated circuit 7400: two-input NAND gates.
• LED.
• Two resistors of 1K and one of 2K2.
• Microswitchs.

Characteristics of CI 7400:



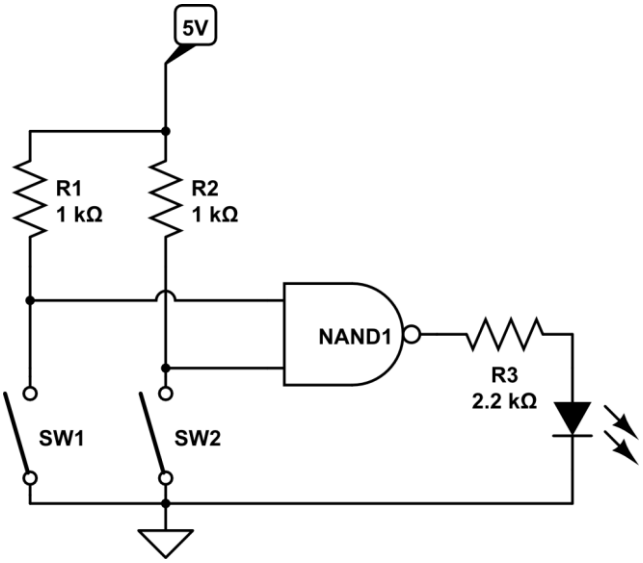
DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

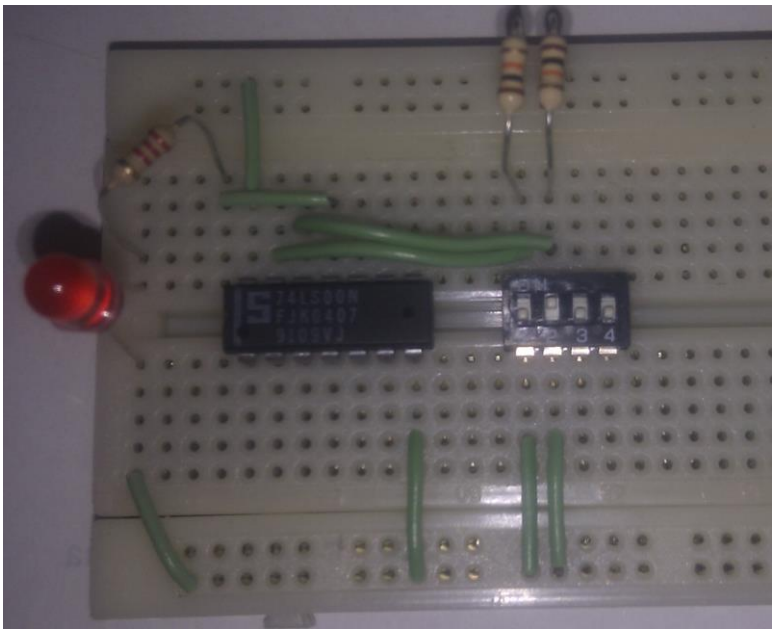
Symbol	Parameter	Limits			Unit	Test Conditions	
		Min	Typ	Max			
V_{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs	
V_{IK}	Input Clamp Diode Voltage		−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
V_{OH}	Output HIGH Voltage	2.7	3.5		V	V_{CC} = MIN, I_{OH} = MAX, V_{IN} = V_{IH} or V_{IL} per Truth Table	
V_{OL}	Output LOW Voltage		0.25	0.4	V	I_{OL} = 4.0 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
			0.35	0.5	V	I_{OL} = 8.0 mA	
I_{IH}	Input HIGH Current			20	μA	V_{CC} = MAX, V_{IN} = 2.7 V	
				0.1	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current			−0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{OS}	Short Circuit Current (Note 1)	−20		−100	mA	V_{CC} = MAX	
I_{CC}	Power Supply Current Total, Output HIGH			1.6	mA	V_{CC} = MAX	
	Total, Output LOW			4.4			

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

Practice Development:

For practical development we use the circuit shown in the following figure. The photograph is an indication to facilitate mounting components, do not follow exactly the assembly shown therein.





1. **Assembly and performance**

Assemble the previous circuit and verify the truth table of the NAND gate.

A	B	NAND
0	0	
0	1	
1	0	
1	1	

Measure the input and output voltages for the different values of the truth table.

A (Voltios)	B (Voltios)	NAND (Voltios)

SECOND PART
Functions with NAND gates

Duration of practice: 2 hours

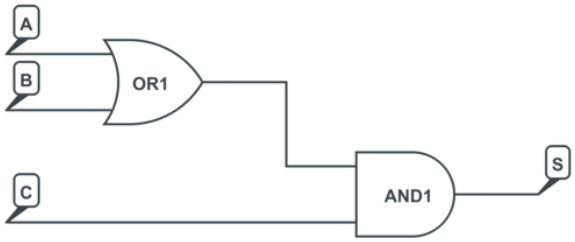
1. 3-input NAND gate

Making a 3-input NAND gate with two input NAND gates. Apply de Morgan laws. Assemble the circuit and verify the truth table.

A	B	C	NAND
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

2. logic Functions

Deduce the logic function performed by the following circuit.



Describe the truth table of the logic function.

A	B	C	S
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	