Experiment No. (3)
## Universal NOR Gate

Objective:

To implement (NOR, NOT, AND, OR) Gates using NOR gates only and realize the Boolean equations for these Gates.

Introduction:

NAND   and NOR gates are called universal gates or universal building blocks because any type of gates or logic functions can be implemented by these gates.

The advantage of using the universal gates for the implementation of logic functions is that it reduces the varieties of the gates required.

The graphical symbols and the Boolean functions of these gates are shown below:

NAND F $F = (xy)'$

NOR F $F = (x + y)'$
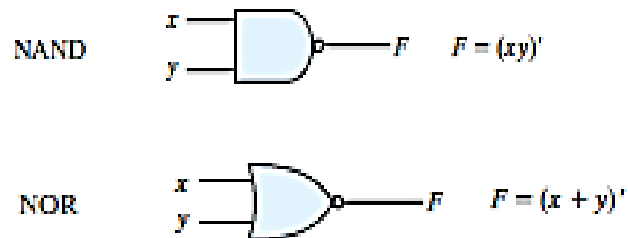
a. NOR Gate Measurement (Module KL-33002 block a)

1. Connect inputs A to SW0, B to SW1 and output F1 to logic indicator L1.

2. Follow the input sequence and record the output states in table (3-1).

INPUT		OUTPUT
SW1 (B)	SW0(A)	F1
0	0	
0	1	
1	0	
1	1	

Table (3-1)

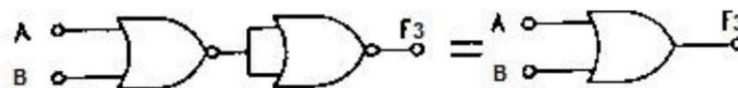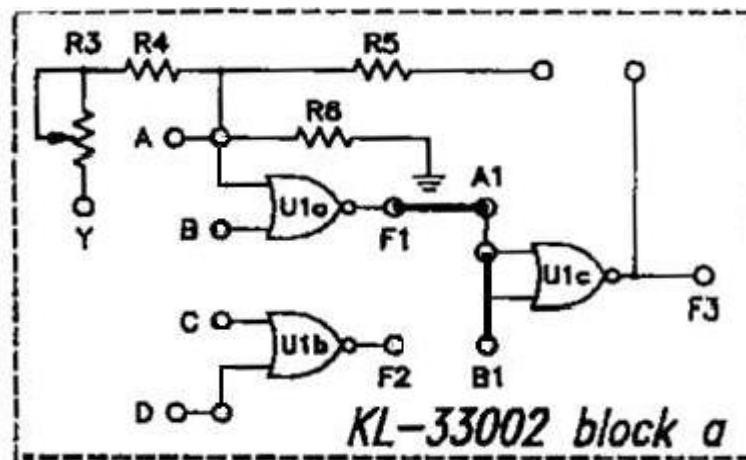**b . NOT Gate Measurement Using NOR gate Only (Module KL-33002 block a)**

1. Connect input A to SW0 and then make a short circuit between A to B. Connect output F1 to logic indicator L1.

2. Follow the input sequence and record the output states in table (3-2).

SW0(A)	F1	
0		
1		

Table (3-2)

c. OR Gate **Measurement Using NOR gate Only** (Module KL-33002 block a)

1. Connect the inputs A, B to the data switch SW0, SW1 on the TTL level.

2. Make a short circuit between the points A1,B1 and F1,A1 as shown in figure (3-1).

3. Connect the output F3 to the logic indicator L0, then follow the input sequences in table(3-3) to record the output value.
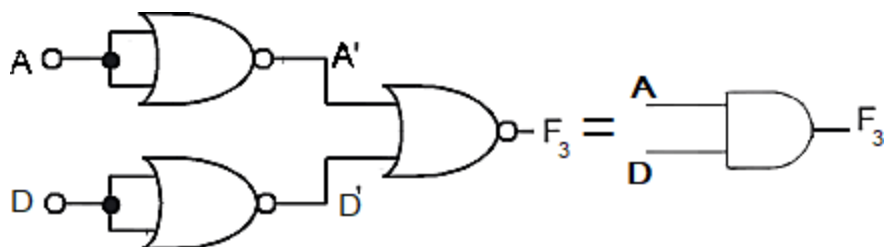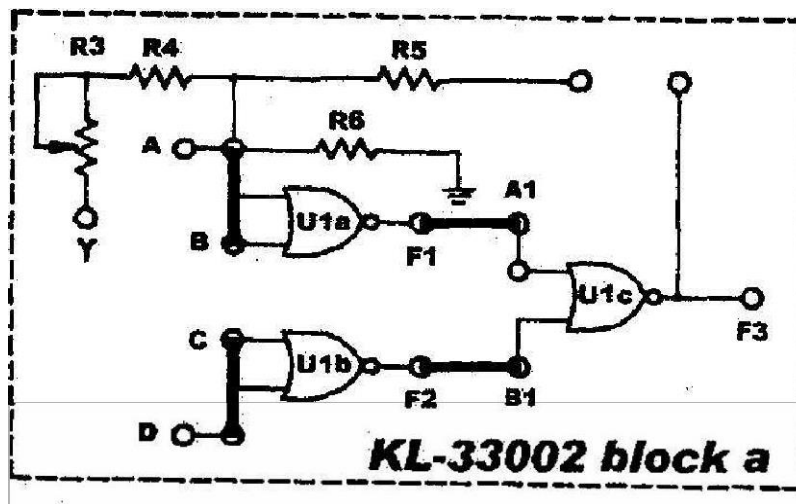

Figure(3-1)

INPUT		OUTPUT
SW1 (A)	SW0(B)	F3
0	0	
0	1	
1	0	
1	1	

Table (3-3)

INPUT		OUTPUT
SW0 (A)	SW1(D)	F4
0	0	
0	1	
1	0	
1	1	

Table (3-4)

d. AND Gate Measurement Using NOR gate Only (Module KL-33002 block a)

1. Insert Connection clips according to the figure below

2. Connect A to SW0, D to SW1, F3 to L0, follow the input sequence and record the output F3 in table (3-4).

Discussion:

1. Construct a two-input XOR & XNOR gates using NOR gates only.

2. Write the Boolean expression for NOR gate in two different format.

3. Realize the following function by NOR gates only, $F = A' + CD + BC'$.