B.Sc. I Semester
Electronics Devices and Circuits
Course Code:C 1 ELE 1 P 1

List of Experiments

1. **Verification of Thevenin's and Norton's theorem**
2. **Superposition theorem**
3. **Zener Diode**
4. **LED characteristics**
5. **Transistor Characteristics**
6. **Basic Gates**
7. **Universal gates**
8. **Binary to gray code and vice versa**
9. **Measurement of voltage and time period of AC using CRO**

Experiment :Verification of Thevenin's and Norton's theorem

Aim:To verify Thevenin's and Norton's theorem for network.

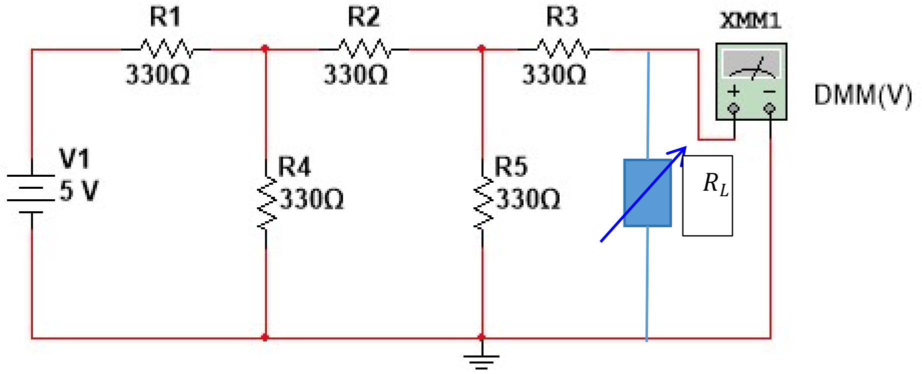
Apparatus:Resistance box,DMM,Power supply, Resistors,Bread board.

Formula:

- $\mathrm{Eth} = \frac{\mathrm{E}}{5}$ V
- $\mathbf{Rth} = \frac{\mathbf{8R}}{\mathbf{5}} = \boldsymbol{R_N}$ **Ω**
- $I_N = \frac{E}{8R}$ mA

Circuit Diagram

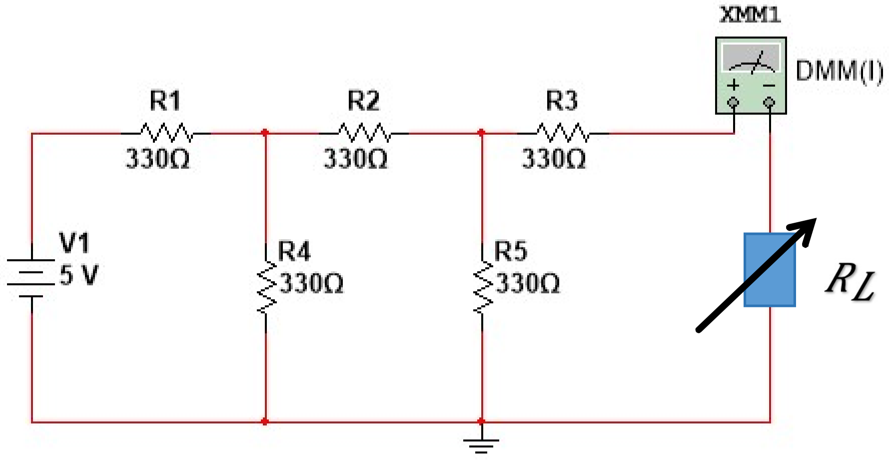
A. Thevenin's Theorem.



Observations:

Calculated Values		Measured values				
E_{Th} (v)	R_{Th} (Ω)	E_{Th} (v)	R_{Th} by half deflection method.I,e R_L when $V_{L=\frac{E_{Th}}{2}}$ in Ω	R_{Th} by different load method		
				R_L (Ω)	V_L (v)	$R_{Th}=(\frac{E_{Th}-V_L}{V_L})R_L(\Omega)$

B. Norton's theorem



Observations:

Calculated Values		Measured values				
I_N (mA)	R_N (Ω)	I_N (mA)	R_N by half deflection method.I,e R_L when $I_{L=\frac{I_N}{2}}$ in Ω	R_N by different load method		
				R_L (Ω)	I_L(mA)	R_N= $(\frac{I_L R_L}{I_N - I_L})$ (Ω)

Result:

	Calculated Values	Measured values
E_{Th} (v)		
R_{Th} (Ω)		
I_N (mA)		
R_N (Ω)		

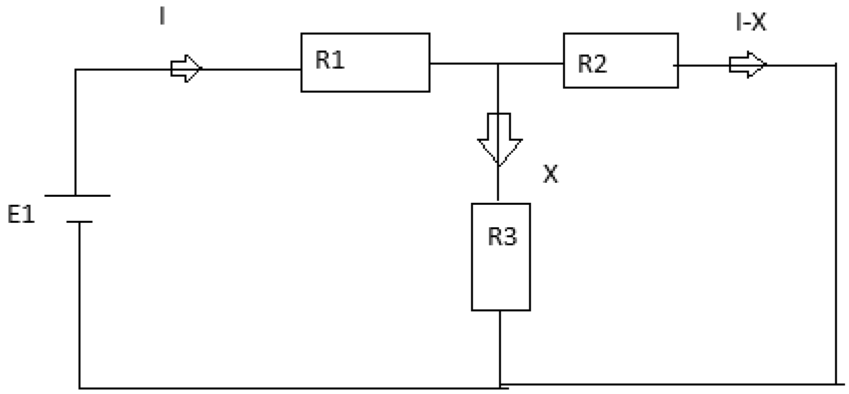
Experiment :Superposition theorem

Aim:To verify the Superposition theorem.

Apparatus: Power supply,Resistors, Bread board, Digital multimeter.

Formula:

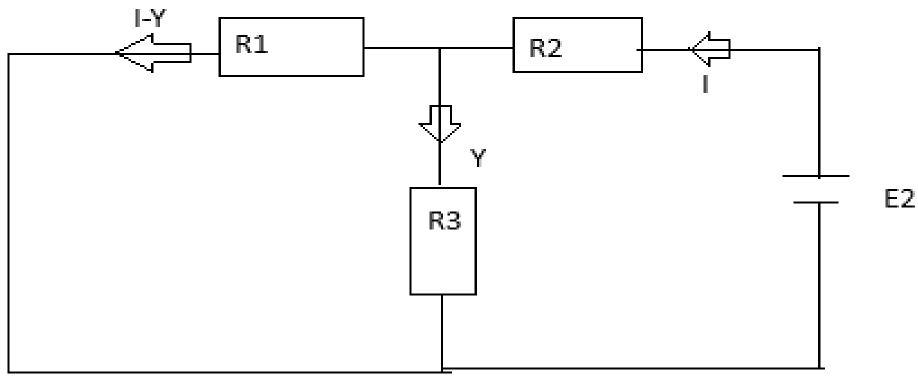
- When E1 source is acting alone.



Total current $I = \frac{E1}{R1+\frac{R2R3}{R2+R3}}$ in amp

Current through R3 due to E1 alone i,e $X = \frac{IR2}{R2+R3}$ in amp

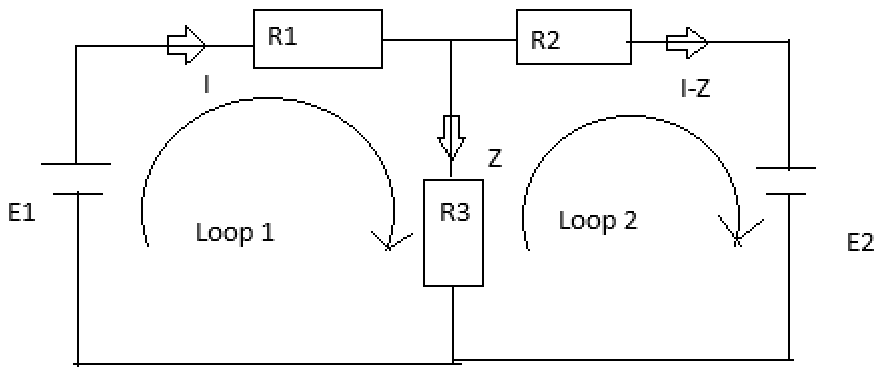
- When E2 source is acting alone.



Total current $I = \frac{E2}{R2+\frac{R1R3}{R1+R3}}$ in amp

Current through R3 due to E2 alone i,e $Y = \frac{IR1}{R1+R3}$ in amp

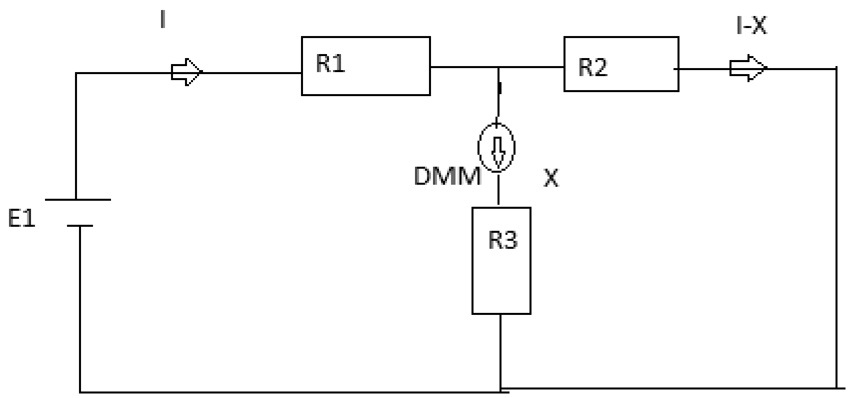
- When both E1 and E2 are acting



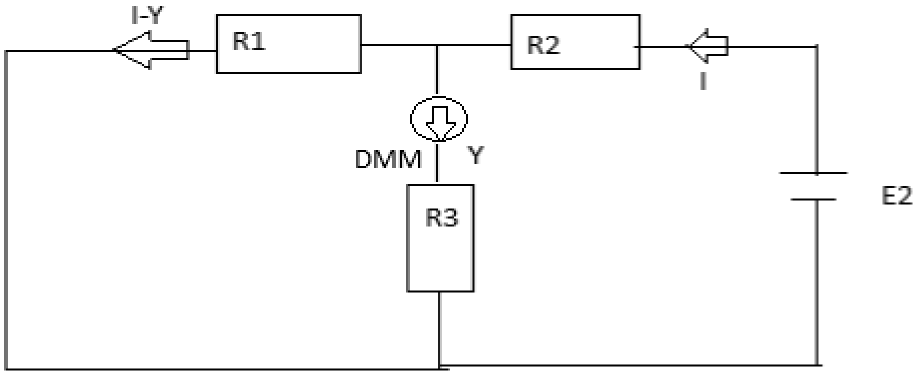
E1=IR1+ZR3 ____________(1)
E2= -(I-Z)R2+ZR3____________(2)
By solving eqn (1) &(2) ,we will get Z I,e current flowing through R3 due to E1 &E2 both.

Circuit Diagram

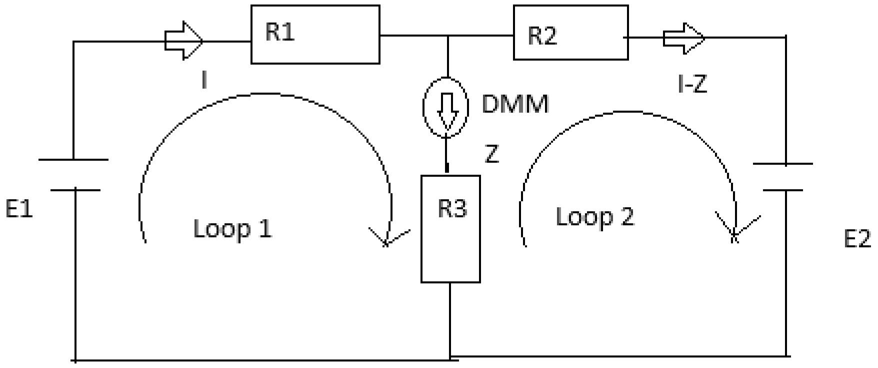
- When E1 source is acting alone.



- When E2 source is acting alone.



- When both E1 and E2 are acting



Observations:

	Calculated current (mA)	**Measured current (mA)**
When E1 source is acting alone.(X)		
When E2 source is acting alone.(Y)		
When both E1 and E2 are acting (Z)		

Result:

Experiment :Zener Diode

Aim:To study the reverse characteristics of zener diode.

Given

Vz= v , Power(P)= watt

Apparatus:Power supply, Zener diode, Resistance box, Rheostat, DMM's.

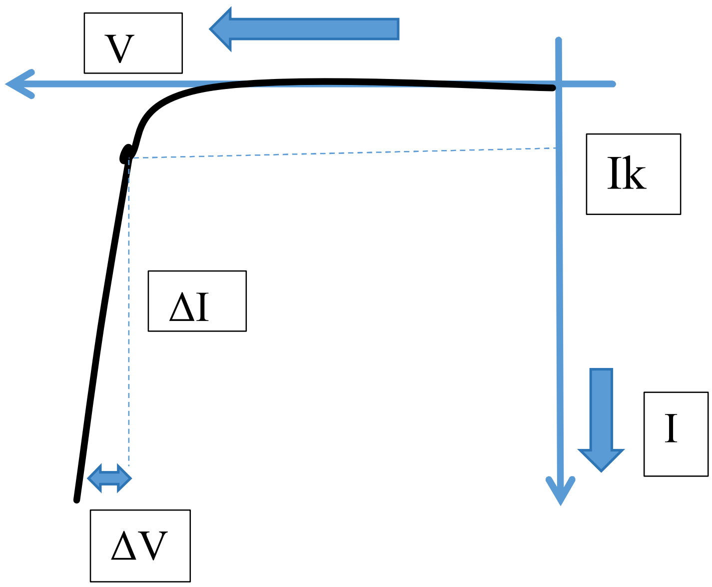
Formula:

Izmax=$\frac{P}{Vz}$ mA

Rs=$\frac{Vin-Vz}{I}$ Ω

Where I is less than Izmax.

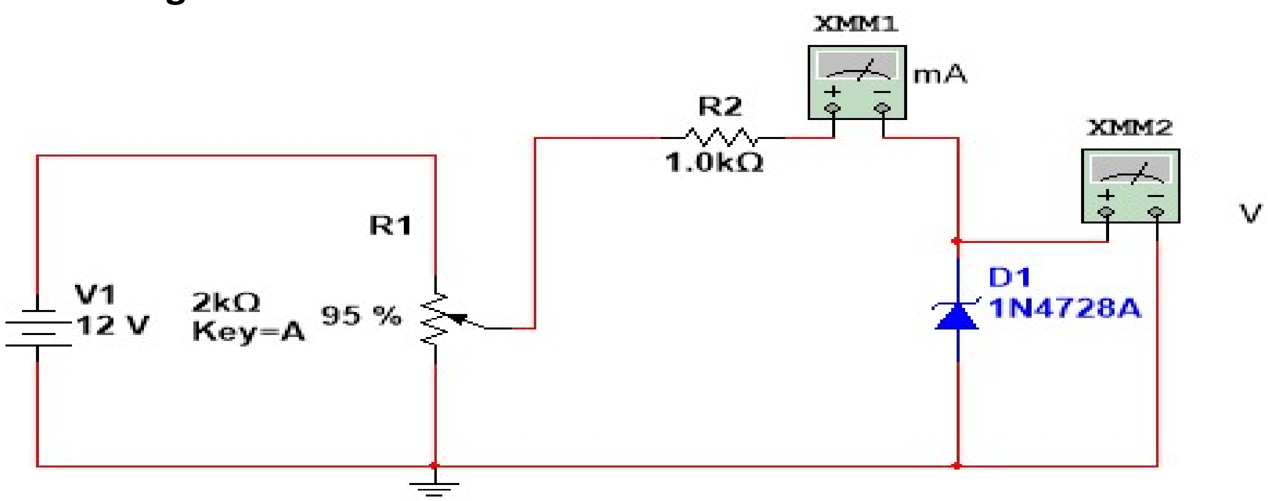
Nature of Graph:



Ik=Knee current

Rz=ΔV/ΔI Ω

Circuit Diagram



Observations:

Trail No	Zener current I(mA)	Voltage across Zener diode V(v)

Result:

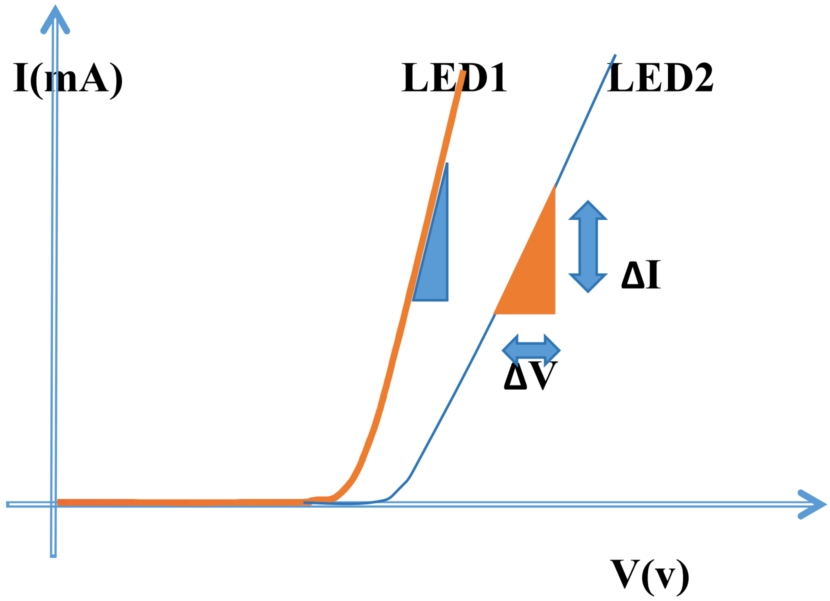
Experiment :LED characteristics

Aim:To study the VI characteristics of LED of two different colors.

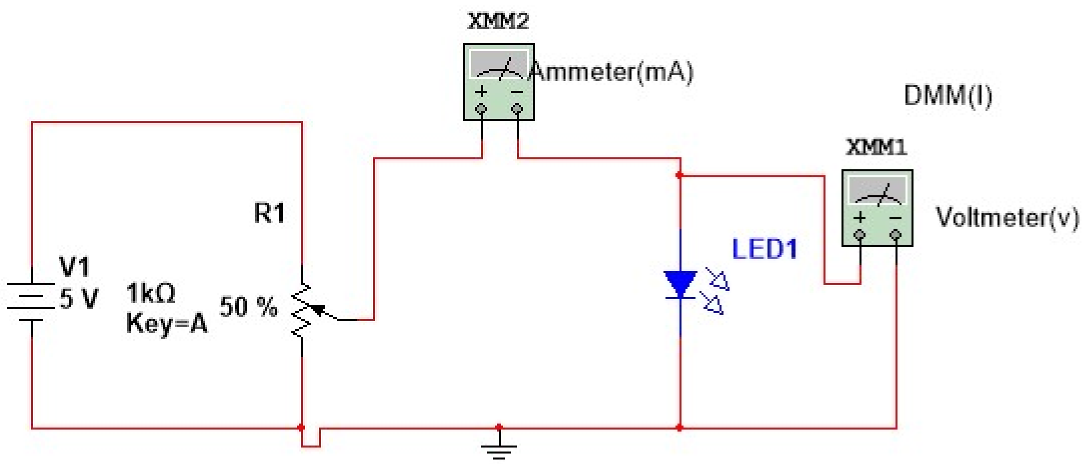
Apparatus:Power supply, Colour LED's, Rheostat, DMM's,Bread board.

Formula: Forward resistance $= R_f = \frac{\Delta V}{\Delta I} \quad \Omega$

Nature of graph:



Circuit Diagram:



Observations:

Current through LED(mA)	Voltage across RED LED(v)	Voltage across Green LED(v)

Result:

Experiment :Transistor Characteristics

AIM:To study the input and output characteristics of a transistor in Common Emitter configuration.And determine the h-parameters.

Apparatus:Transistor BC 107 , No. 2 Resistors, Bread board, Dual DC Regulated Power supply , DMM'S, Connecting wires (Single Strand) Few.

Formula: **h-parameters**

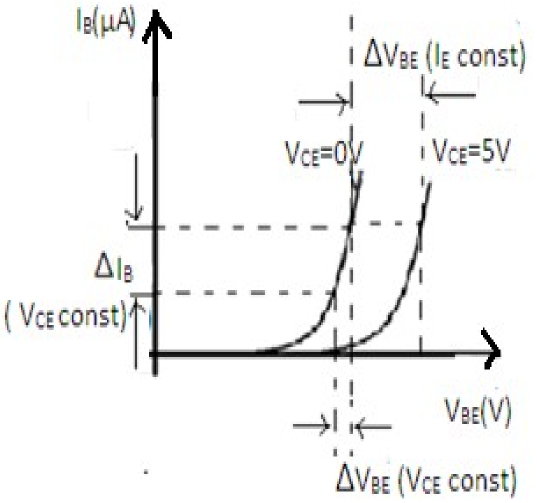
Input impedance = hie = Ri = VBE / IB (VCE is constant)

Reverse voltage gain = hre = VEB / VCE (IB = constant)

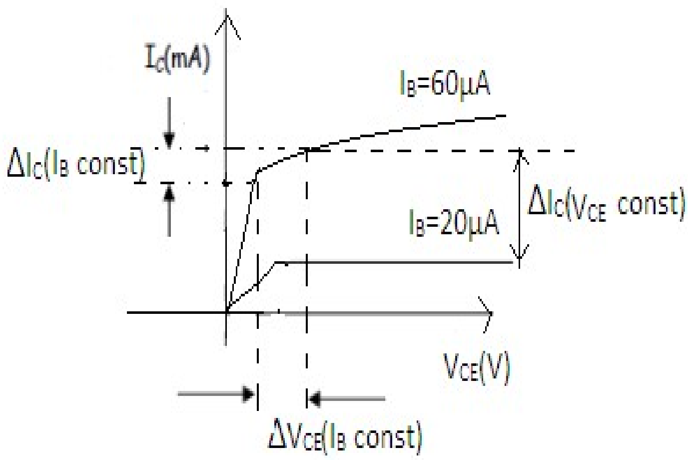
Output admittance 1/hoe = Ro = IC / VCE (IB is constant)

Forward current gain = hfe = IC / IB (VCE = constant)

Graph:

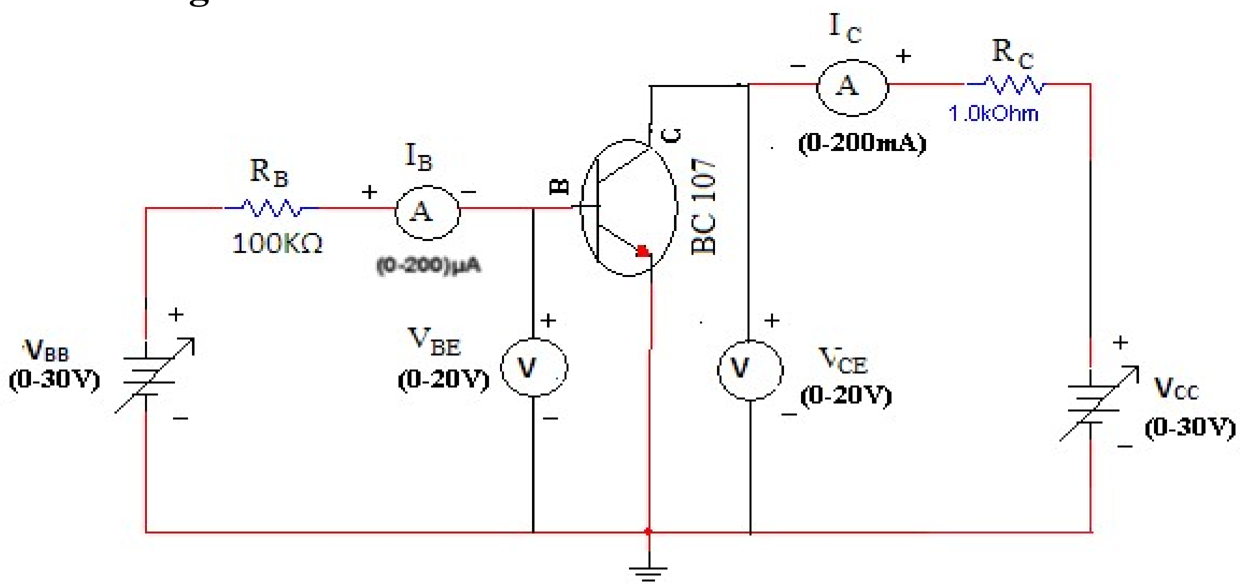


Input Characteristics



Output Characteristics

Circuit Diagram:



Observations:

Input Characteristics				
V_{BB} (Volts)	$V_{CE} = 0V$		$V_{CE} = 5V$	
	V_{BE} (Volts)	I_B (µA)	V_{BE} (Volts)	I_B (µA)

Output Characteristics						
V_{CC} (Volts)	$I_B = 0$ µA		$I_B = 20$ µA		$I_B = 40$ µA	
	V_{CE} (Volts)	I_C (mA)	V_{CE} (Volts)	I_C (mA)	V_{CE} (Volts)	I_C (mA)

Result:

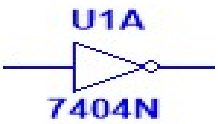
Experiment :Basic Gates

Aim:Verification of truth tables of NOT,OR,AND,NAND,NOR,XOR and XNOR gates using IC's.

Apparatus:Power supply, Bread board, Resistor, IC's.

Basic Gates and Truth Table:

1. NOT gate

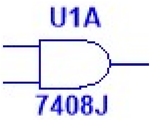


INPUT	OUTPUT
0	1
1	0

2. OR gate

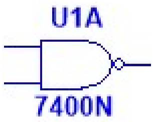
INPUTS		OUTPUT (Y)
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

3. AND gate



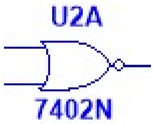
INPUTS		OUTPUT (Y)
A	B	
0	0	0
0	1	0
1	0	0
1	1	1

4. NAND gate



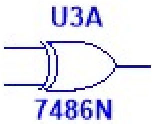
INPUTS		OUTPUT (Y)
A	B	
0	0	1
0	1	1
1	0	1
1	1	0

5. NOR gate



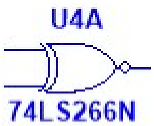
INPUTS		OUTPUT (Y)
A	B	
0	0	1
0	1	0
1	0	0
1	1	0

6. XOR gate



INPUTS		OUTPUT (Y)
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

7. XNOR gate



INPUTS		OUTPUT (Y)
A	B	
0	0	1
0	1	0
1	0	0
1	1	1

Result:

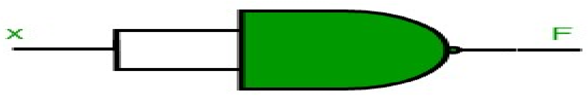
Experiment :Universal gates

Aim:Implementation of various gates by using universal properties of NAND & NOR gates and Verify the truth table.

Apparatus:Power supply, Bread board, Resistor, IC's.

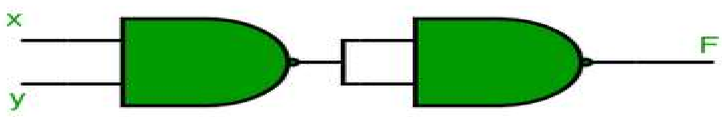
1)Verification of different gates using NAND gate

NOT gate



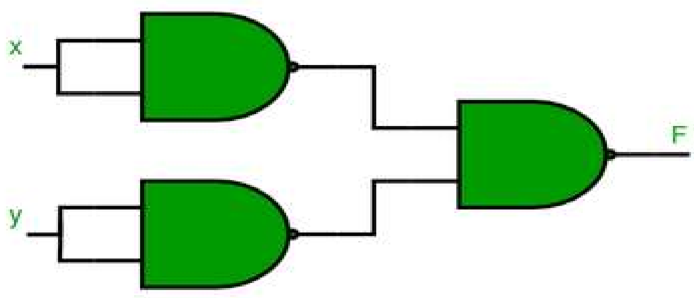
x	F
0	1
1	0

AND gate



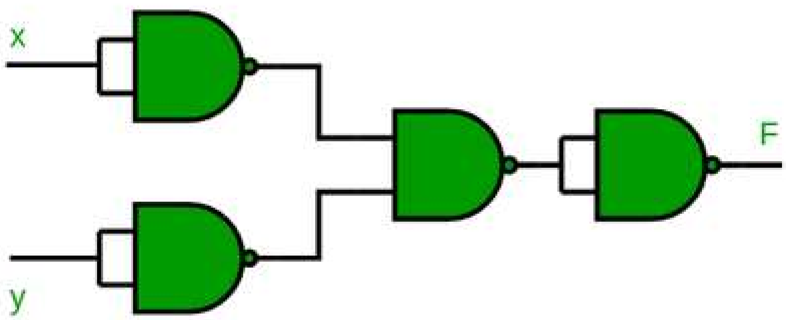
x	y	F
0	0	0
0	1	0
1	0	0
1	1	1

OR gate



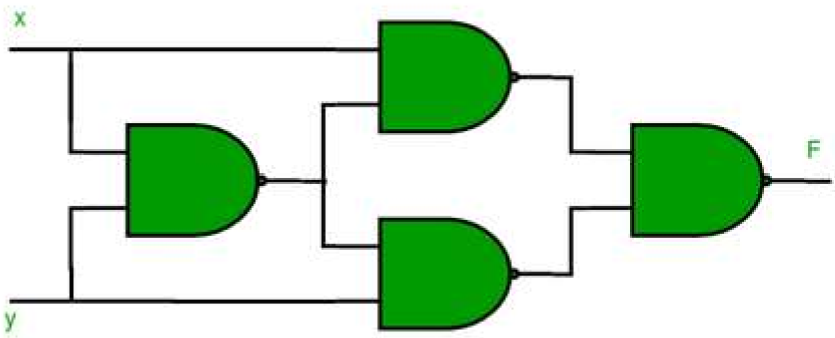
x	y	F
0	0	0
0	1	1
1	0	1
1	1	1

NOR gate



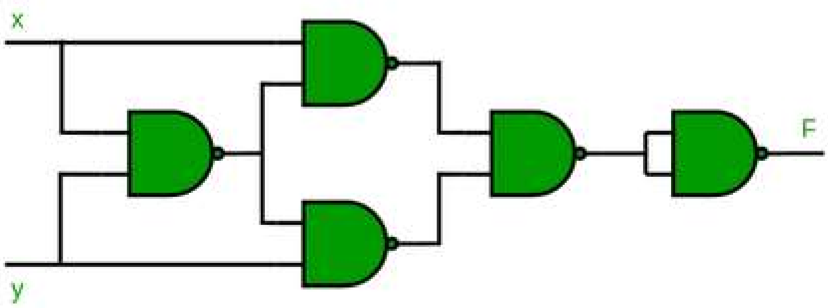
x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

XOR gate



x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

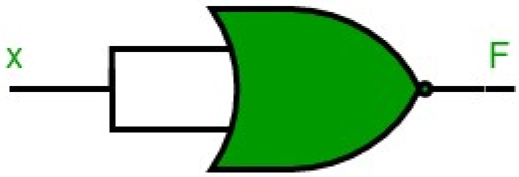
XNOR gate



x	y	F
0	0	1
0	1	0
1	0	0
1	1	1

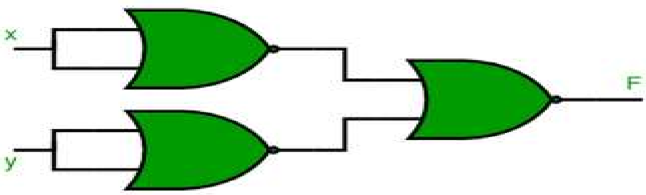
2)Verification of different gates using NOR gate

NOT gate



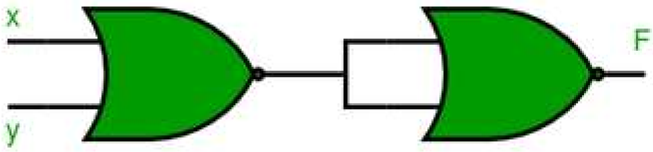
x	F
0	1
1	0

AND gate



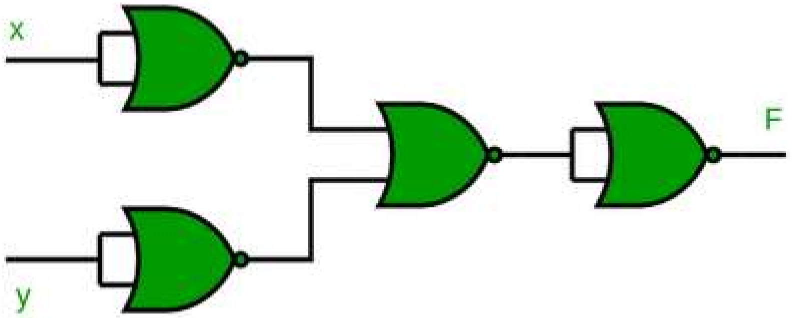
x	y	F
0	0	0
1	0	0
1	1	1
0	1	0

OR gate



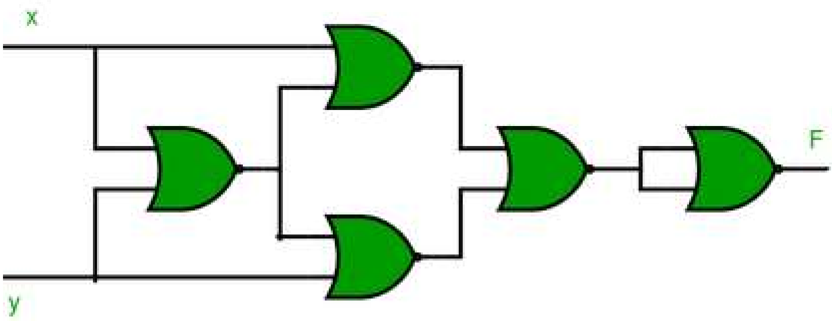
x	y	F
0	0	0
0	1	1
1	0	1
1	1	1

NAND gate



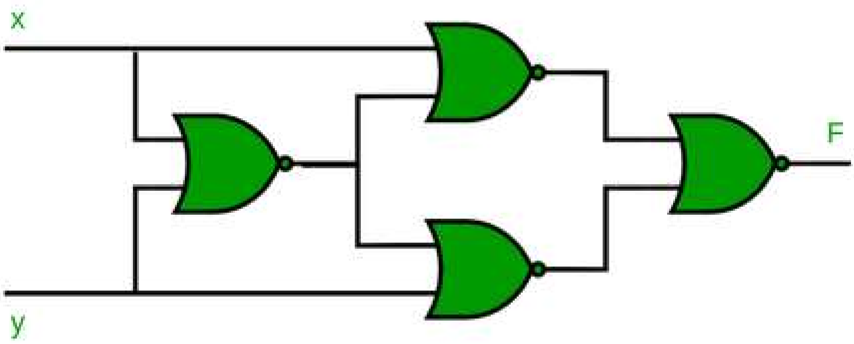
x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

XOR gate



x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

XNOR gate



x	y	F
0	0	1
0	1	0
1	0	0
1	1	1

RESULT:

Experiment :Universal gates

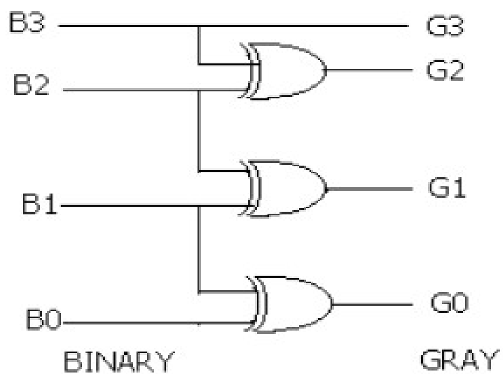
Aim:To convert binary to gray code and vice versa.

Apparatus:Power supply, Bread board, Resistor, IC's(7486).

A)Binary to Gray:

BINARY				GRAY CODE			
Inputs				Outputs			
B3	B2	B1	B0	G3	G2	G1	G0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

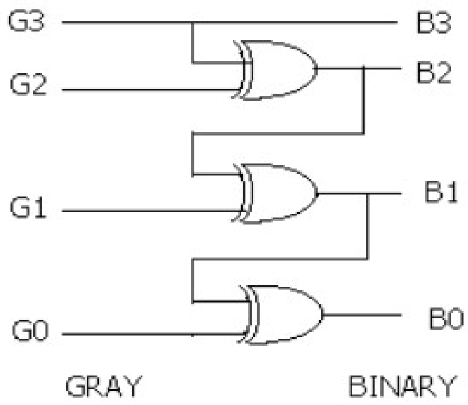
Using XOR Gates:



B)Gray to Binary:

GRAY CODE				BINARY CODE			
Inputs				Outputs			
G3	G2	G1	G0	B3	B2	B1	B0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
1	0	0	0	1	1	1	1
1	0	0	1	1	1	1	0
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	1	0	1	1
1	1	1	1	1	0	1	0

Logic Diagram:



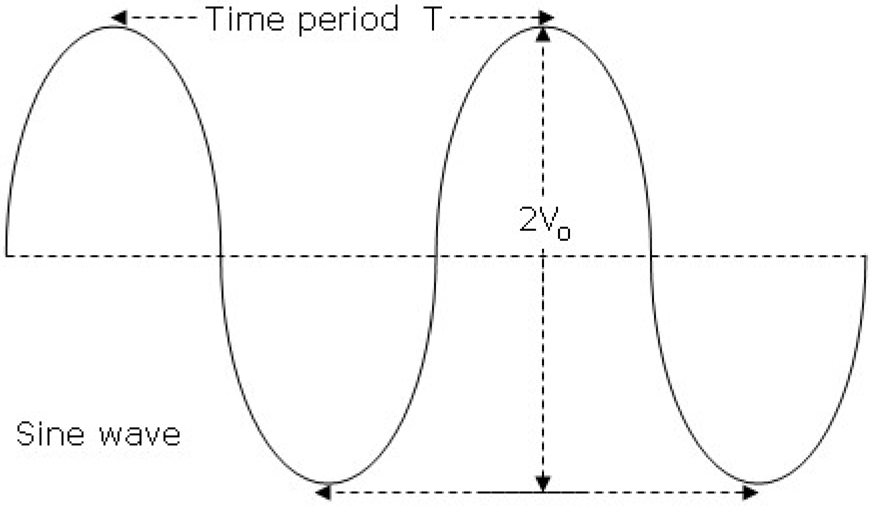
Result:

Experiment : Measurement of voltage and time period of AC using CRO

Aim:- To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO .

Apparatus:- A C.R.O and a signal generator.

Graph:



Voltage measurement :

S.No	Peak to peak (Vertical) length. (Divisions) (l)	Voltage Sensitivity. (Volt/Div) (n)	Peak to peak Voltage $2V_o$=nxl (volts)	Peak voltage V_o=($2V_o$/2) (volts)	Rms Voltage V_{rms}=($V_o/\sqrt{2}$) (volts)	Measured voltage with Multi-meter (volts)
1.						
2.						
3.						
4.						
5.						

Frequency/Time Period measurement :

S.No.	Peak to peak (Horizontal) length (Divisions) (l)	Time-base Sec/Div (m)	Time-period T = mxl Sec.	Measured frequency f= 1/T Hz	Applied Frequency Hz
1.					
2.					
3.					
4.					
5.					
6.					

Procedure:-

Study of waveforms: To study the waveforms of an A.C voltage, it is led to the y – plates and the time base voltage is given to the X-plates. The size of the figure displayed on the screen, can be adjusted suitably by adjusting the gain controls. The time base frequency can be changed, so as to accommodate one, two or more cycles of the signal. There is a provision in C.R.O to obtain a sine wave or a square wave or a triangular wave.

Measurement of D.C.Voltage : - Deflection on a CRO screen is directly proportional to the voltage applied to the deflecting plates. Therefore, if the screen is first calibrated in terms of known voltage. i.e. the deflection sensitivity is determined , the direct voltage can be measured by applying it between a pair of deflecting plates. The amount of deflection so produced multiplied by the deflection sensitivity, gives the value of direct voltage.

Measurement of A.C voltage : - To measure the alternating voltage of sinusoidal waveform, The A.C. signal, from the signal generator, is applied across the y – plates. The voltage(deflection) sensitivity band switch (Y-plates) and time base band switch (X plates) are adjusted such that a steady picture of the waveform is obtained on the screen. The vertical height (l) i.e. peak-to-peak height is measured. When this peak-to-peak height (l) is multiplied by the voltage(deflection) sensitivity (n) i.e. volt/div, we get the peak-to-peak voltage (2Vo). From this we get the peak voltage (Vo). The rms voltage Vrms is equal to Vo/ 2 . This rms voltage Vrms is verified with rms voltage value, measured by the multi-meter.

Measurement of frequency : - An unknown frequency source (signal generator) is connected to y- plates of C.R.O . Time base signal is connected to x – plates(internally connected) . We get a sinusoidal wave on the screen, after the adjustment of voltage sensitivity band switch (Y-plates) and time base band switch (X-plates). The horizontal length(l) between two successive peaks is noted. When this horizontal length (l) is multiplied by the time base(m) i.e. sec/div , we get the time-period(T).The reciprocal of the time-period(1/T) gives the frequency(f). This can be verified with the frequency, measured by the multi-meter.

Precautions :- 1) The continuity of the connecting wires should be tested first.

2) The frequency of the signal generator should be varied such that steady wave form is formed.

Results : -