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EXPERIMENT NO. -7

Objective : To study the input and output characteristics of semiconductor diodes

Software Used : NI Multisim 14.0

Theory :

A semiconductor diode is a combination of p and n type semiconductors which in forward bias at which the flow of current during the PN Junction begins increasing rapidly is known as **cut**-in **voltage .** After achieving cutting voltage the increase in current is almost exponential . A diode in reverse bias conducts negligible amount of current in the order of micro amperes .

$$I = I0\ (e^{(v/(\eta v\ T\ ) - 1)}$$

Where ,

I = current flowing through the diode

I0 = reverse saturation current,

q = charge on the electron,

V = voltage applied across the diode,

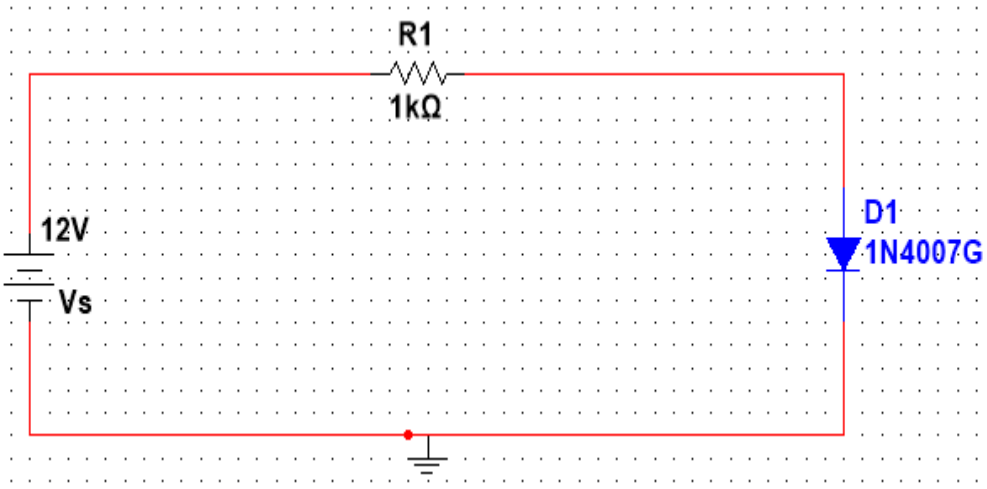
η = ideality factor (Ge = 1 and Si = 2) .

T is the absolute temperature in Kelvin.

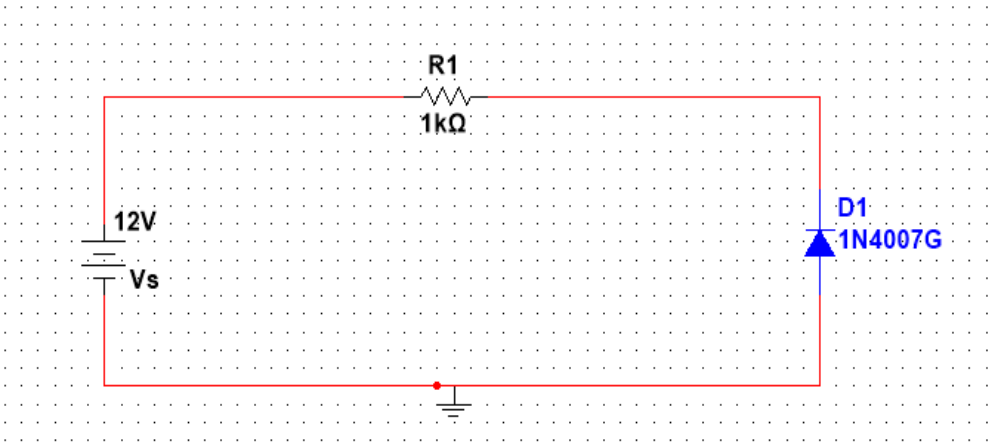
The configuration in which the emitter is connected between the collector and base is known as a common emitter configuration. The input circuit is connected between emitter and base , and the output circuit is taken from the collector and emitter **.**

Circuit Diagram :

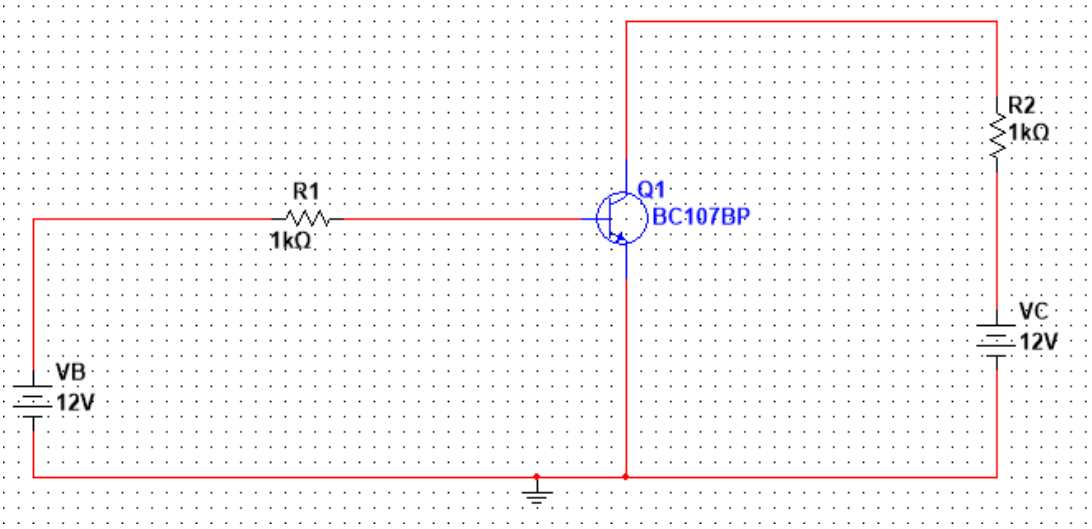
1 . Diode in Forward Bias :



2 . Diode in Reverse Bias :



3 . Common Emitter Configuration :

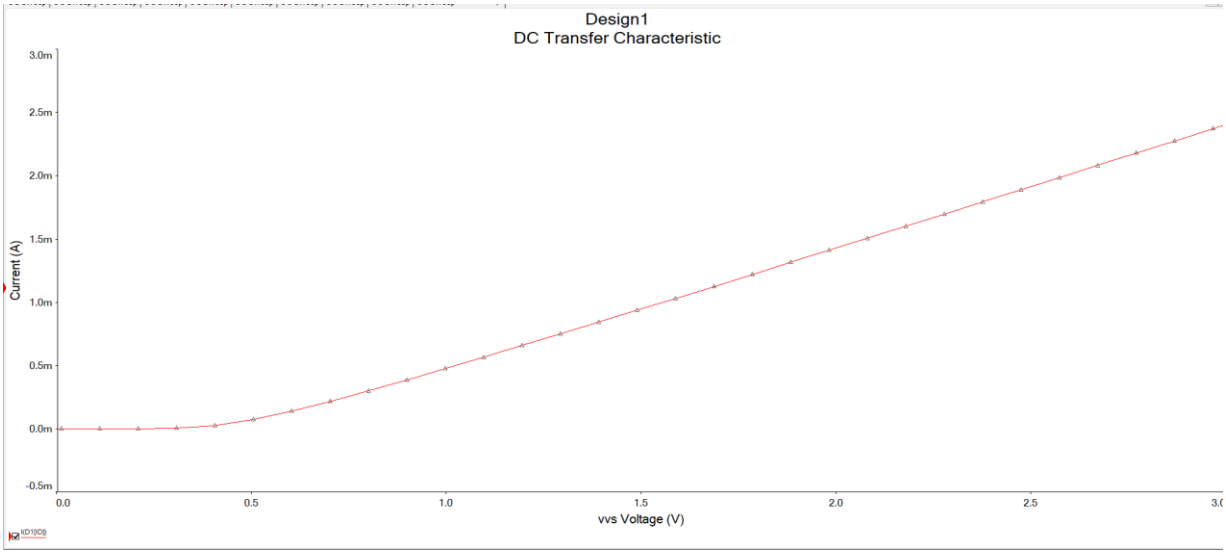


Results &Observations :

1 . Diode is in Forward Bias :

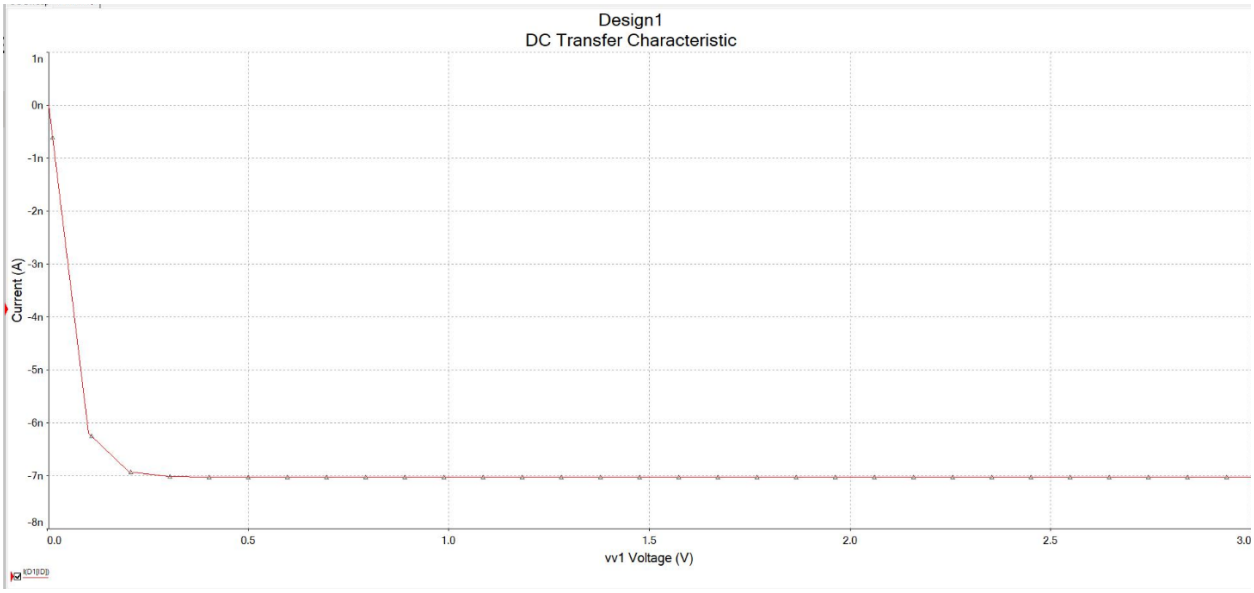
The Cutting Voltage for the diode is 0.3 V .

Therefore the diode is a Germanium Diode .

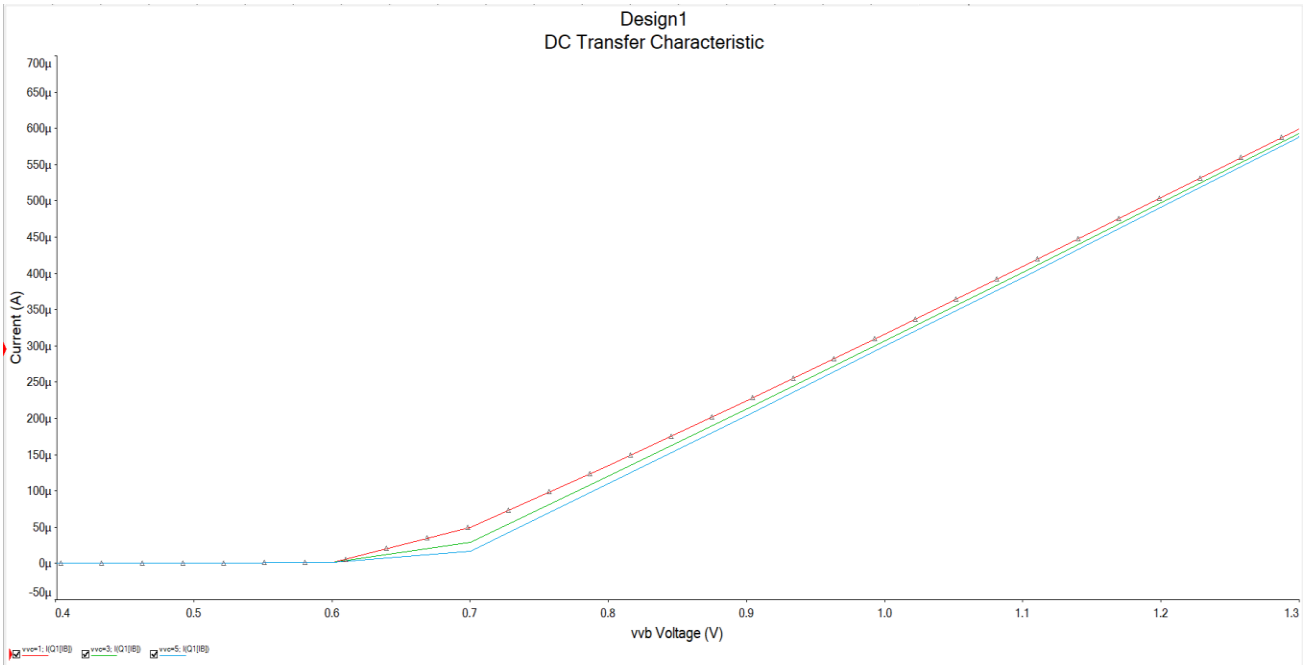


2 . Diode is in Reverse Bias :

The leakage current is negligible or zero .

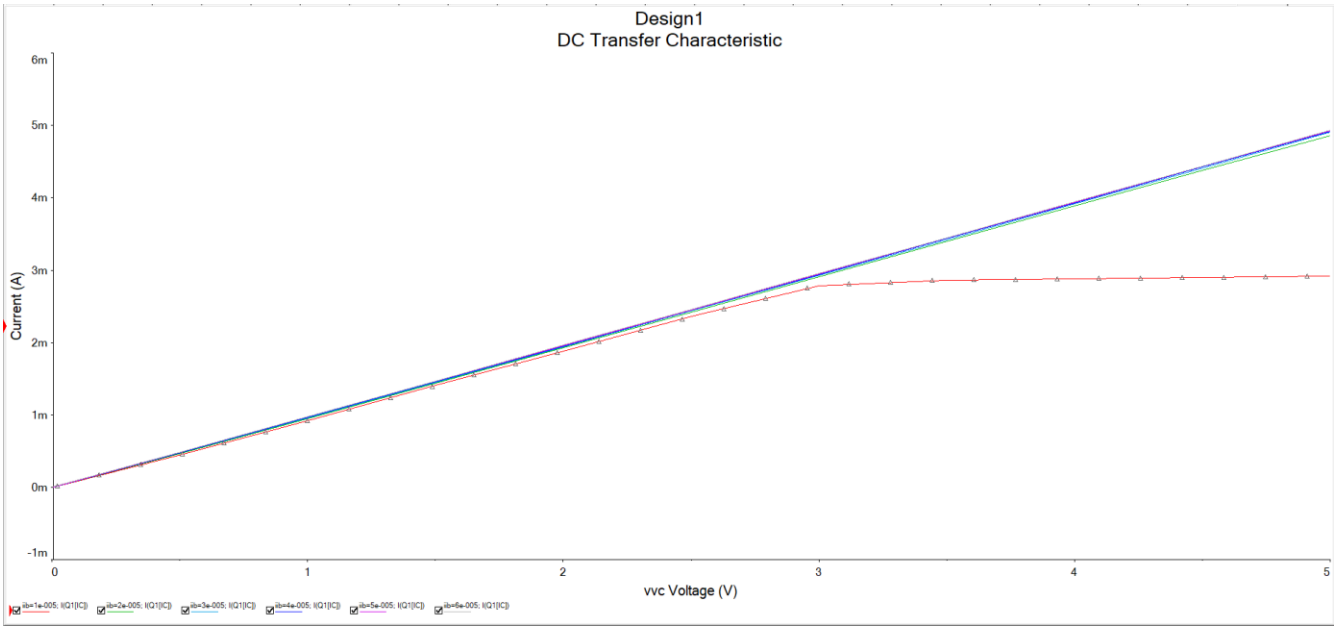


3 . Common Emitter Configuration Input Characteristics :



	Voltage (V_C)		
	1V	3V	5V
Cutting Voltage (V_γ)	0.500V	0.506V	0.510V

4 . Common Emitter Configuration Output Characteristics :



	Base Current (I_B)		
	10µA	30µA	50µA
Collector Current (I_C)	2.77mA	8.74mA	14.46mA

EXPERIMENT NO. – 8

Objective : To design and simulate the half wave rectifier and full wave rectifier.

Software used : NI Multisim

Theory :

A rectifier is a circuit that converts the Alternating Current (AC) input power into a Direct Current (DC) output power.

Half wave rectifiers use one diode, while a full wave rectifier uses multiple diodes.

“ The power diode in a half-wave rectifier circuit passes just one half of each complete sine wave of the AC supply to convert it into a DC supply. Then this type of circuit is called a **“ Half-wave rectifier ”**, because it passes only half of the incoming AC power supply **” .**

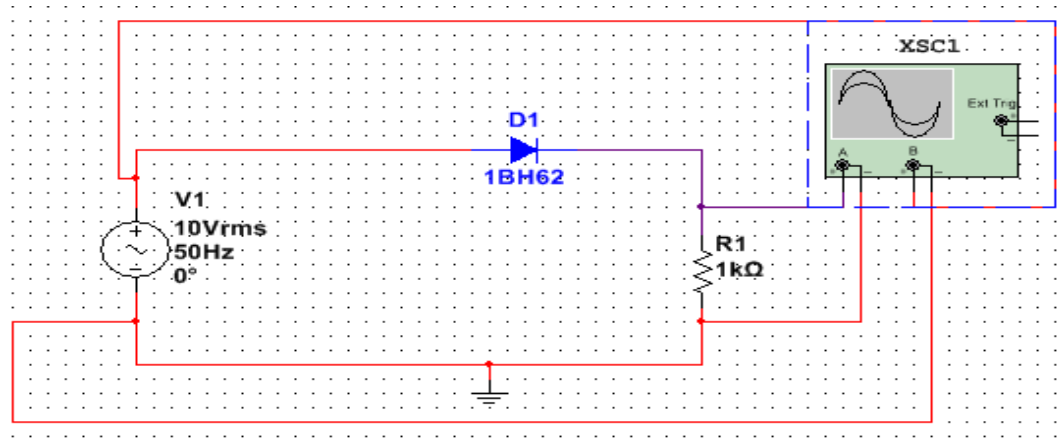
During each **“** positive **”** half cycle of the AC sine wave, the diode is forward biased as the anode is positive concerning the cathode resulting in current flowing through the diode. During each **“** negative **”** half cycle of the AC sinusoidal input waveform, the diode is reverse biased as the anode is negative concerning the cathode. Therefore, NO current flows through the diode or circuit .

“ Full-wave rectifier rectifies the negative component of the input voltage to a positive voltage then converts it into DC current utilizing a diode **bridge** configuration **” .**

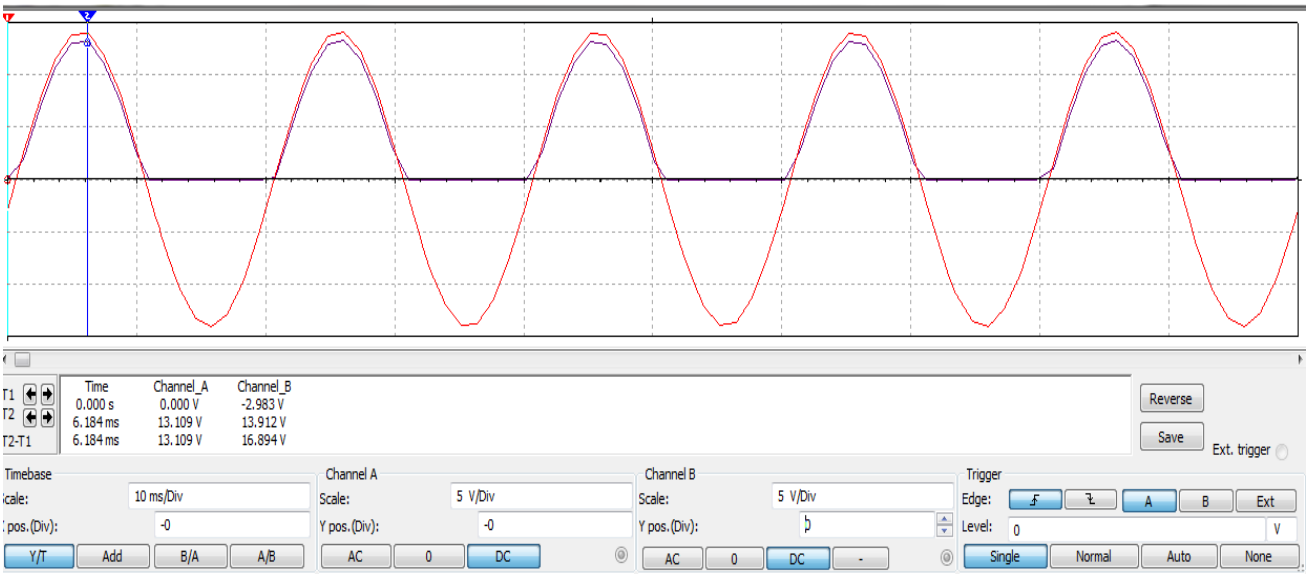
“ Bridge rectifier can be defined as a type of full-wave rectifier that uses four or more diodes in a bridge circuit configuration to efficiently convert alternating (AC) current to a direct (DC) current **” .**

Circuit Diagram :

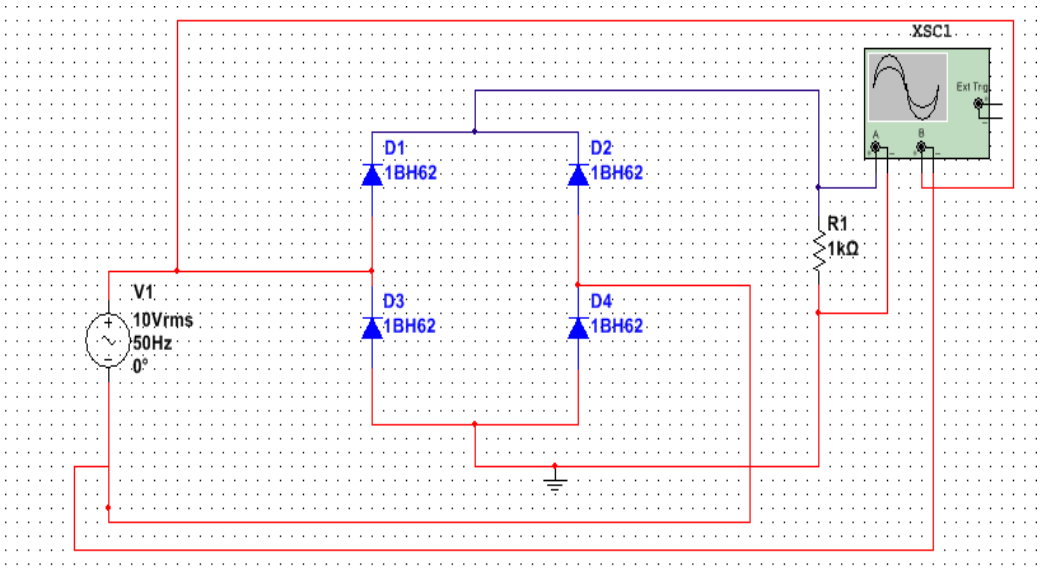
1 . Half Wave Rectifier :



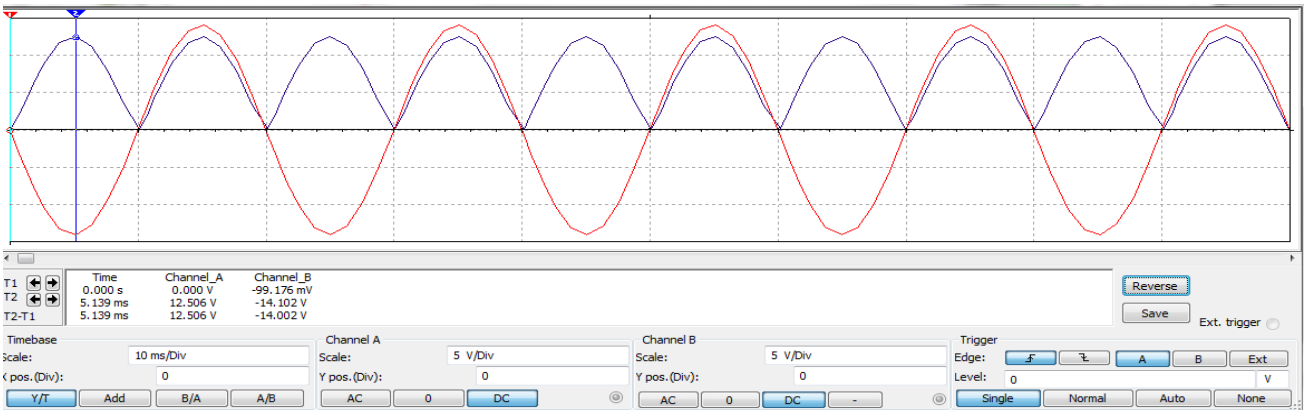
Graph :



2 . Full Wave Rectifier :



Graph :



Results & observations :

Half wave Rectifier :

Theoretical values :

Vm = 10√2 V

Vrms = Vm/2 = 10√2/2 =7.07 V

VDC = Vm/π =14.14/ π = 4.50 V

γ = √(Vrms/VDC)^2 – 1

= 1.211

Experimental Values :

Vm = 13.109 V

Vrms = Vm/2 = 13.109/2 = 6.55 V

VDC = Vm/π = 13.109//π = 4.172 V

γ = √(Vrms/VDC)^2 – 1

= 1.210

Full Wave Rectifier :

Theoretical values :

$V_m = 10\sqrt{2} = 14.14$ V

$V_{rms} = V_m/\sqrt{2} = 10$ V

$V_{DC} = 2V_m/\pi = 9.003$ V

$\gamma = \sqrt{(V_{rms}/V_{DC})^2 - 1}$

$= 0.483$

Experimental Values :

$V_m = 12.506$ V

$V_{rms} = V_m/\sqrt{2} = 12.506//\sqrt{2} = 8.84$ V

$V_{DC} = 2V_m/\pi = 7.961$ V

$\gamma = \sqrt{(V_{rms}/V_{DC})^2 - 1}$

$= 0.482$

	Vm		**Vrms**		**VDC**		**γ**	
Half-wave Rectifier	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**
	14.14V	13.109V	7.07V	6.55V	4.50V	4.172 V	1.211V	1.210 V
Full-wave Rectifier	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**	**Theoretical**	**Multisim**
	14.14V	12.506V	10V	8.84V	9.003V	7.961 V	0.483V	0.482 V