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EXPERIMENT - 01

Object : Study of CRO and measurement of voltage and frequency.

Apparatus Used : CRO, resistor, inductor, capacitor, diode, zener diode and transistor.

Theory : The Cathode Ray Oscilloscope (CRO) is a common laboratory instrument that provides accurate timer and measurement of voltage or amplitude signal over a wide range of frequency.

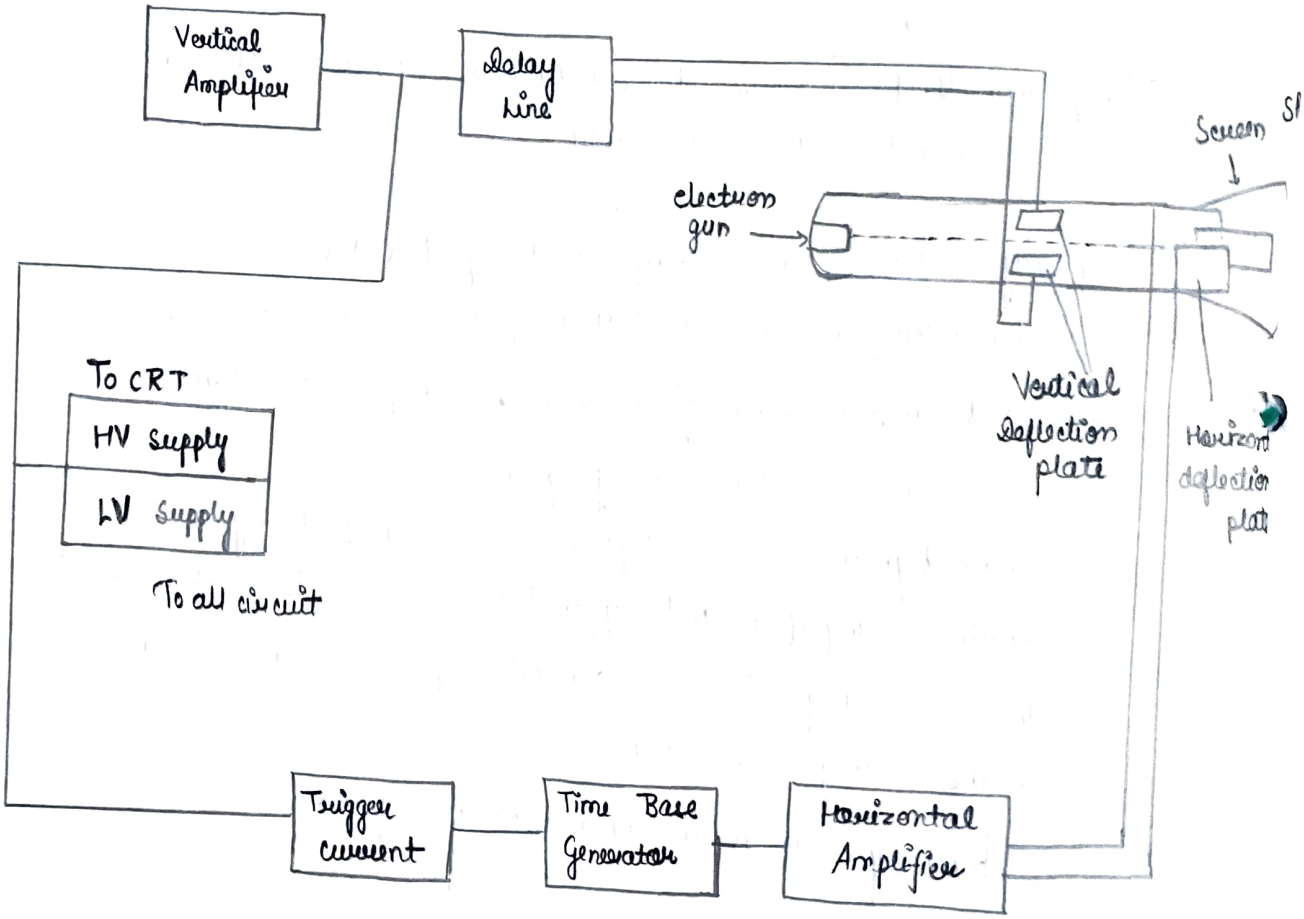
The signals to be displayed is amplified by a vertical amplifier and applied to the vertical plate of the CRT sweep trigger generation pulse which switches on the sweep generator.

Initially, it is a saw tooth waveform.

Function generator : It provides many types of waveform such as sine wave, triangular wave, rectangular wave, etc. The frequency range should be adjusted with the range of 1% to 18%. The level of signal can be adjusted with the help of knob. The signal frequency can be displayed in the LED light.

Measurement of voltage and frequency :

First of all, function generator is set upon a frequency which is obtained as a sine wave by counting the



Block Diagram of CRO

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Multimeter
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It consists
1) % error

2) % erro

number of blocks carved by the highest point.
The amplitude and the line curved is measured, then this number is multiplied to the value of voltage, then for the calculation of frequency:

$$\text{frequency (f)} = \frac{1}{\text{Time period}}.$$

Take 50Hz on the function generator.
Measure voltage = 2.3 X 1V = 2.3V
where 2.3 are the number of blocks measured where amplitude was the reading which the knob of amplifier reads.

$$\text{Time period} = \frac{1}{f}$$

$$\text{So, } f = \frac{1}{T} = \frac{1}{2.2} \times 1000 = 454.54 \text{ Hz}.$$

Multimeter: A multimeter also known as Volt ohm meter (VOM) is an electronic measuring instrument that combine several functions in one unit.
A typical multimeter could include basic features such as the ability to measure current and resistance. It consists of two meter lead.

1) % error = $\frac{\text{actual value} - \text{calculated value}}{\text{actual value}}$

2) % error = $\frac{500 - 454.54}{500} \times 100 = 9.092\ \%$.

Observation Table :

S. No.	Time per division	Time period (ms)	Amplitude (V)	frequency (Hz)
01.	1 millisecond	2×10^{-3} s	20V	500Hz

Result: Different figures of various circuit has been verified through the experimental while testing for the connection.

Precautions :

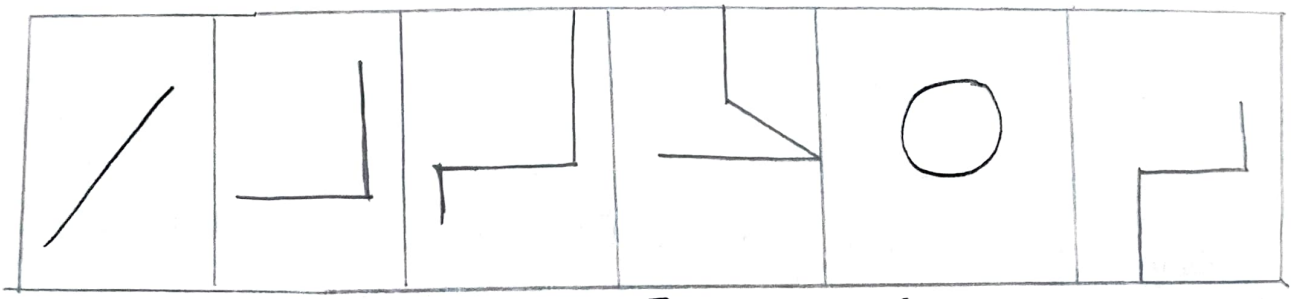
1) The output waveform must be carefully and precisely matched to the respective component.

2) Never advance the intensity control so as bright spot appears on screen.

Calculations

$$\% \text{ Error} = \frac{\text{Actual value} - \text{calculated}}{\text{Actual value}} \times 100$$

$$= \frac{530 - 500}{530} \times 100 = 5.66\%$$


Resistor
Junction BC
Junction B.F.
Junction FC.
Capacitor
Zener diode
|EV|

Experiment - (2)

Objective : Testing of active and passive components with the help of CRO and digital multimeter.

Apparatus : CRO, resistance, Capacitance, Inductance, Classical diode, Zener diode.

Theory : In component testing process, we test the continuity and IV-characteristics of various component like resistor, capacitor diode.

Observation Table :

S.No.	Component	Active / Passive
1	Resistance	Active
2	Capacitor	Active
3	Inductor	Active
4	Classical Diode	Active
5	Zener Diode	Active.

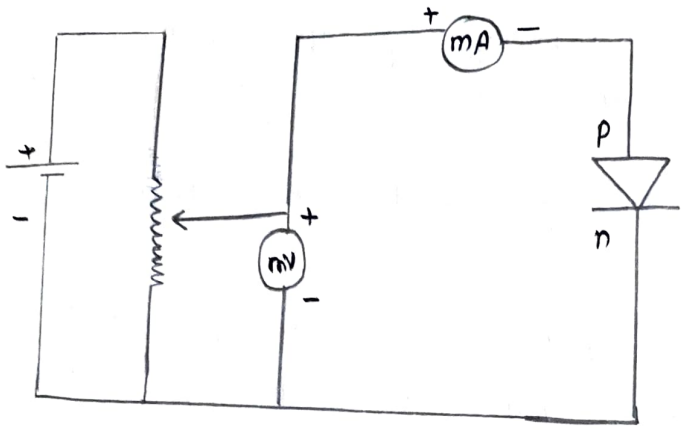
Result : Different circuit component used are in active mode.

Precautions :

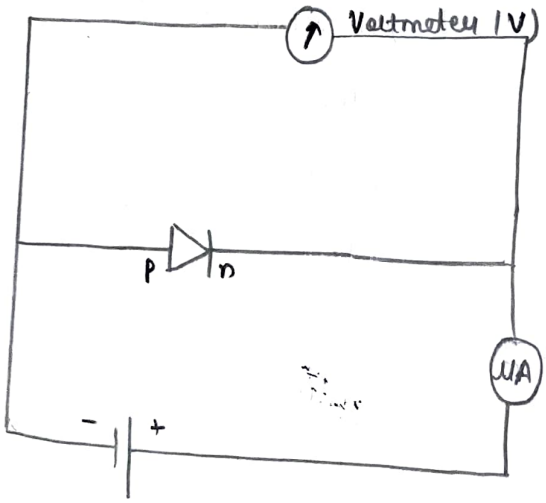
1) There must be continuous supply of electric current.

2) We must check component from both end.

3) The CRO function generator must be used in working condition.



p-n junction diode in Forward Biasing.



p-n junction diode in Reverse Biasing.

TUTORIAL / PRACTICAL No. 03

EXPERIMENT- 03

Object: To plot VI- characteristics of junction diode under forward and reverse bias condition.

Apparatus Used: P-N junction diode, Ammeter, Voltmeter, Variable power supply.

Theory:

1. Zero External Voltage:

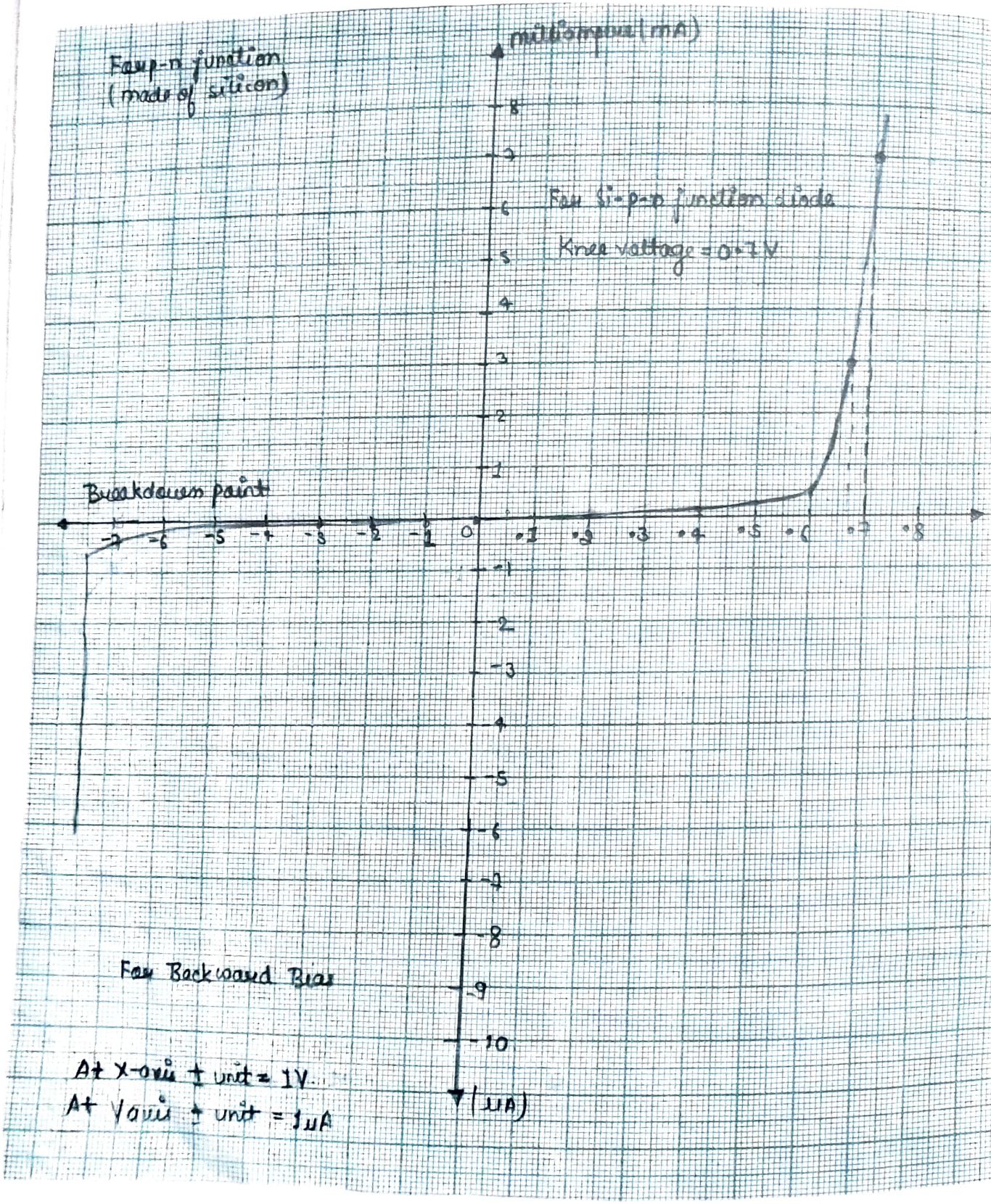
When external voltage is zero, i.e. the circuit is open, the potential barrier at junction do not permit current to flow. At this point, circuit current is zero.

2. Forward Biased:

The depletion barrier depletion region is produced by applying forward biased resulting in heavy majority flow across the junction as the applied bias is increased, the depletion region is further reduced.

3. Reverse Biased:

Applying the reverse bias across the terminal bias situation and the current flowing in this condition is called leakage current.


For p-n junction
(made of silicon)
milliampere (mA)
For Si-p-n junction diode
Knee voltage = 0.7 V
Breakdown point
For Backward Bias
At x-axis 1 unit = 1V
At y axis 1 unit = 1 μA
(μA)

TUTORIAL / PRACTICAL No.

Observation Table

FORWARD BIAS		REVERSE BIAS	
V(volt)	I(mA)	V(volt)	I(μA)
0.1	0.0	-1	0.0
0.3	0.0	-2.1	0.10
0.5	0.1	-3.0	0.20
0.6	0.1	-4.0	0.30
0.6	1.1	-5.1	0.40
0.7	7.1	-6.1	0.53
		-7.1	0.63

Result: We performed a forward and reverse Bias properly using p-n diode.

Precautions:

1) Circuit should be carefully tight.
2) Take readings carefully.
3) Do not touch the naked wire.

TUTORIAL / PRACTICAL No. 04

EXPERIMENT-04

Aim: To observe the relation between the voltage and corresponding current generated by Zener diode.

Apparatus: Zener diode, DC voltage supplies, 100Ω resistor, 2 multimeter for measuring voltage and current.

Theory:

A zener diode is constructed for operation in the reverse breakdown region. Relation between I-V characteristic is almost linear in this case.

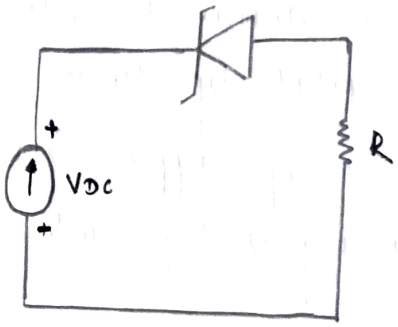
$$V_Z = V_{Z0} + I_Z r_Z$$

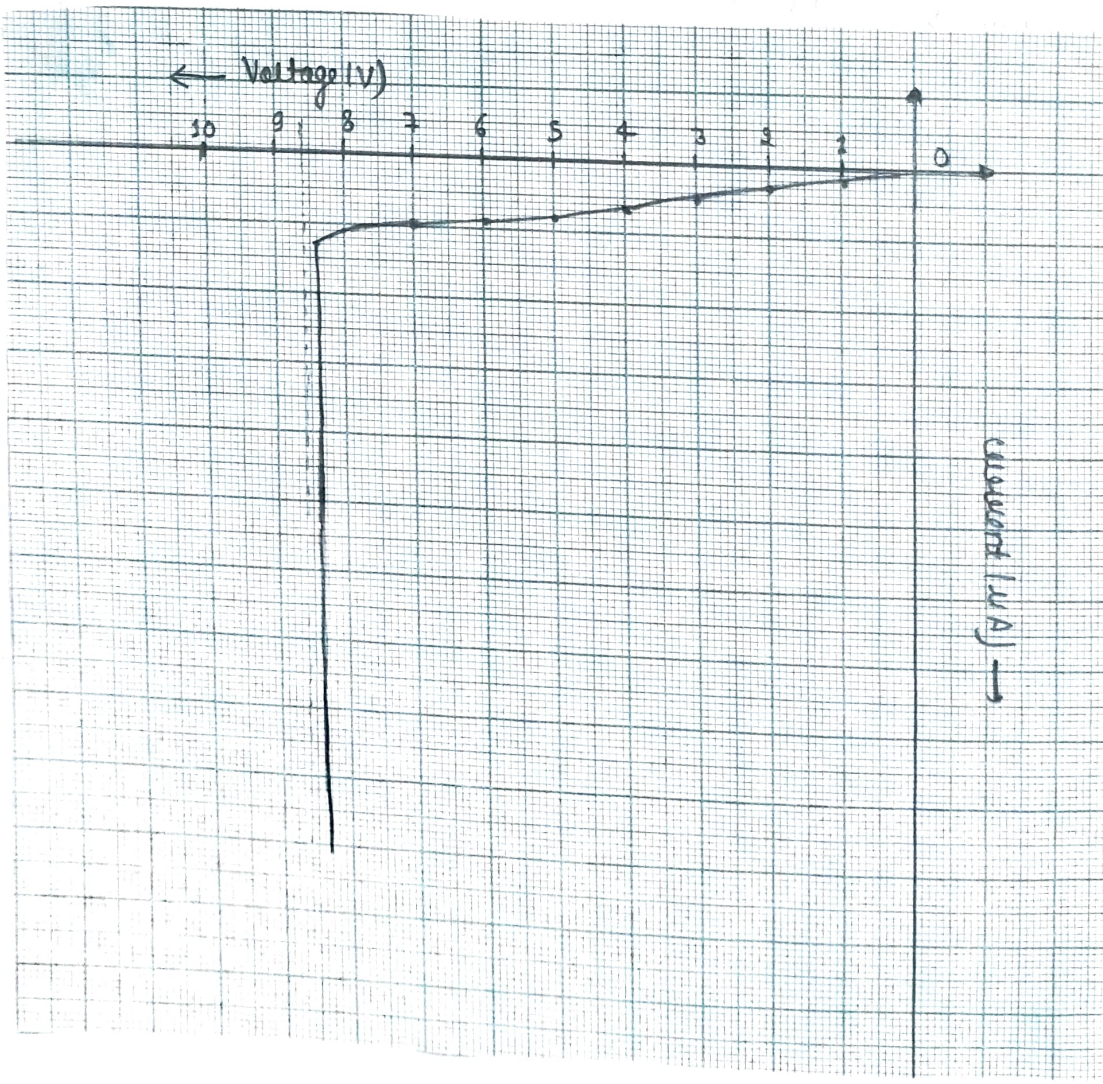
, r_Z is the dynamic resistance of the zener at the operating point.

V_{Z0} is the voltage at which the straight line approximation of the IV characteristics intersects the horizontal axis. After reaching a certain voltage, called the **breakdown voltage**, the current increases widely even for a small change in voltage.

So, when we plot the graph, we should get a curve very near to X-axis, almost parallel to it for quite sometime, after the zener potential V_Z there will be sudden change and the graph will become exponential.

Zener diode.





TUTORIAL / PRACTICAL No.

Observation Table :

Voltage (V)	Current (uA)
-0.2	0.0
-0.3	0.0
-1.0	0.1
-1.8	0.2
-2.4	0.3
-3.4	0.4
-4.1	0.5
-5.1	0.6
-6.0	0.7
-6.7	0.8
-7.6	0.9
-8.0	0.91
-8.2	0.95
-8.6	89.0

Result :- Breakdown potential is also called zener potential, i.e. $V_z = 8.6$

Precautions :

1) Excessive flow of current should be avoided as it can damage diode.

2) Circuit should be tight carefully.

$$\% \text{ error} = \frac{|8.0 - 8.6|}{8.0} \times 100$$

$$= \frac{0.6 \times 100}{8} = 7.5\%$$

EXPERIMENT - 05

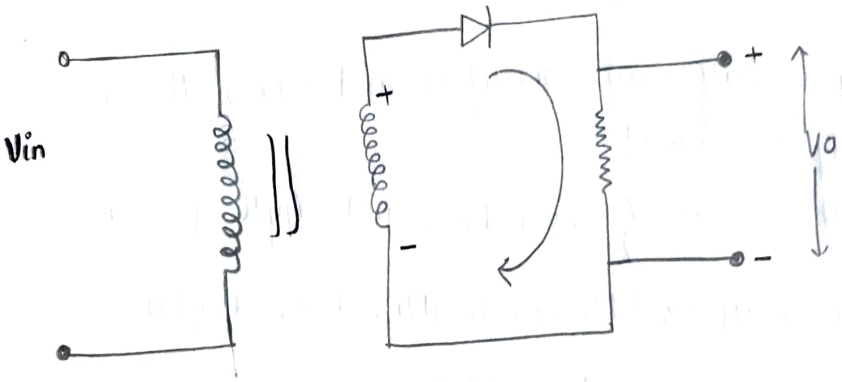
Objective : Study of half wave rectifier and draw the nature of input & output signal.
Calculate the value of I_{DC}, I_{rms} and ripple factor.

Apparatus : CRO, Resistor (1kΩ), multimeter, diodes, transformers, connecting wires.

Theory : A rectifier is a ckt that converts a pure AC signal to a pulsating DC signal or a signal that is combination of AC and DC components.

A half wave rectifier makes use of single diode to carry out this conversion. During the positive half cycle, the diode is forward biased and it conducts and hence a current flows the load resistor. During the -ve half cycle, the diode is reverse biased and it is equivalent to an open circuit, hence the current through the load resistance is zero. Thus the diode conducts only for one half cycle and results in a half wave rectified output.

Ripple factor : It is defined as the ratio of the effective value of AC components to the average DC value.


Vin
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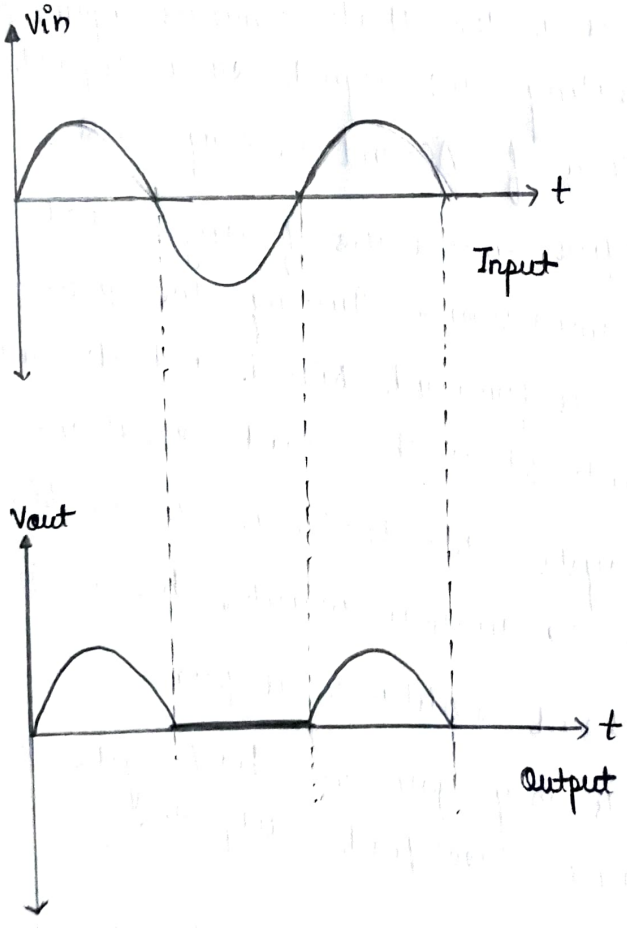
+
-
Vo


Vin
t
Input
Vout
t
Output

Calculations :

$V_{output/Ac} = 12.80$ volts

$V_{dc} = 10.98$ volts

$$\gamma = \frac{V_{output}}{V_{dc}} = \frac{12.80}{10.98} = 1.16$$

$$\% \text{ ERROR} : = \frac{|1.16 - 1.21|}{1.21} \times 100$$

$$= \frac{5}{1.21} = 4.132\%$$

Result :- The ripple factor of half wave rectifier is 1.16

Precautions :

1) Avoid parallax error.
2) Remain out of touch of naked wires.
3) Make sure that connections are tight.
4) Do not play with instruments.

EXPERIMENT-06

Objective: Trace the waveform of input and output of full wave rectifier, and measurement of its ripple factor.

Apparatus Used: Cathode ray Oscilloscope, full wave rectifier, connecting wire.

Theory: When input AC signal supply is applied on transformer, secondary becomes positive and negative half cycle alternatively.

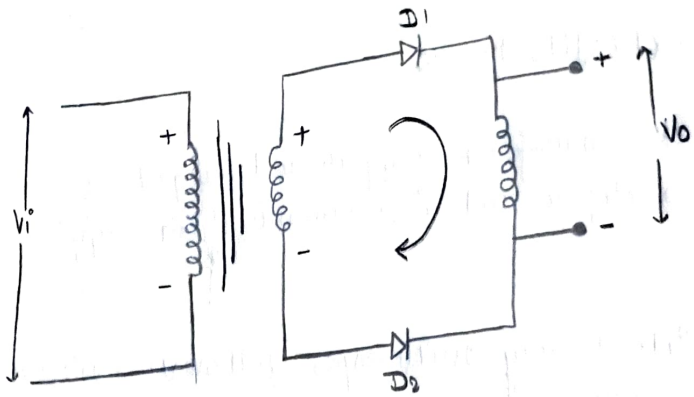
During the +ve half cycle of AC input, one diode (D1) is forward biased and another diode (D2) is reverse biased and during negative half cycle of Ac input, one diode (D2) is forward biased and another diode (D1) is reverse biased.

Hence, both cycles of input AC signal are used to form DC output, and frequency of output signal is twice the frequency of applied input AC signal.

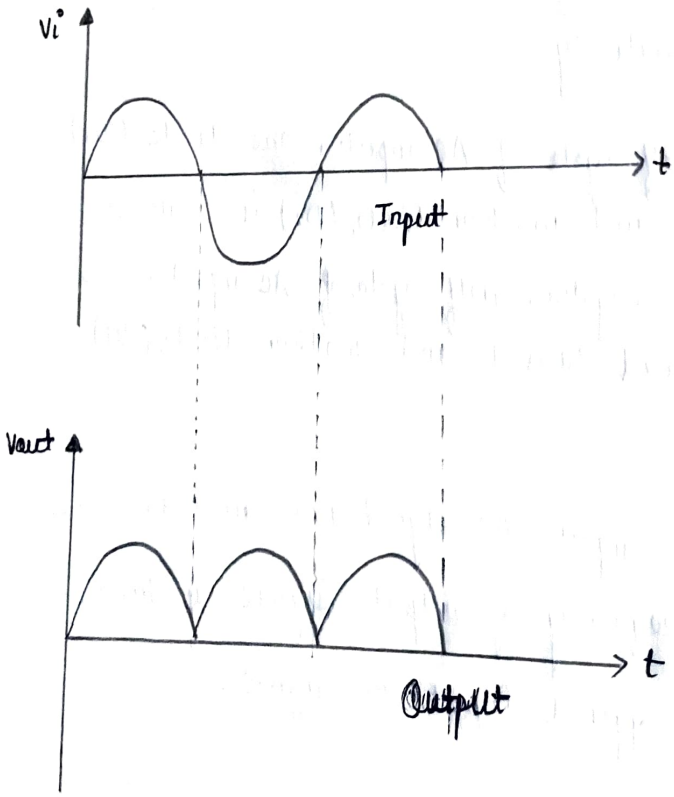
Ripple Factor:

$$\gamma = \frac{(V)_{out\ ac}}{V_{dc}}$$

(γ_{std}) value $= 0.48$



Full wave Rectifier.



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Calculations :

$(V_{output})_{AC} = 5.28$ volts

$V_{dc} = 10.50$ volts

$$\gamma = \frac{(V_{out})_{AC}}{V_{dc}} = \frac{5.28}{10.50} = 0.502$$

Std value = 0.48

$$\% \text{ error} : \frac{|0.48 - 0.502|}{0.48} \times 100$$

$$= \frac{2.2}{0.48} \times 100$$

$$= 4.58\%$$

Result : The ripple factor of full wave rectifier is 0.502

Precautions :

1) Reading taken should be accurate.
2) Avoid parallax error.
3) Keep away from touch of naked wires.