# Experiment No. 4: Diode as Rectifier

## Objectives:

To become familiar with Full wave and Half wave rectification.

### Equipment:

Oscilloscope

Function Generator

Digital Multimeter (DMM)

### Components

Diodes: Silicon (D1N4002)

Resistor: 2.2 kΩ,

## Theory:

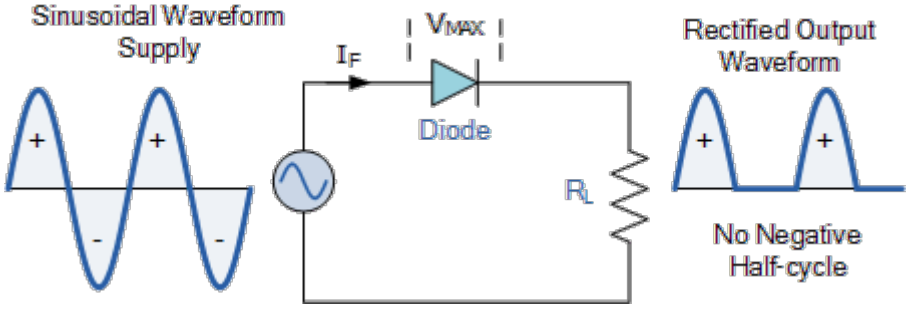
**Diode:**

A diode is a two-terminal electronic component that conducts current primarily in one direction; it has low resistance in one direction, and high resistance in the other.

A widely used application of this feature and diodes in general is in the conversion of an alternating voltage (AC) into a continuous voltage (DC). In other words, *Rectification*.

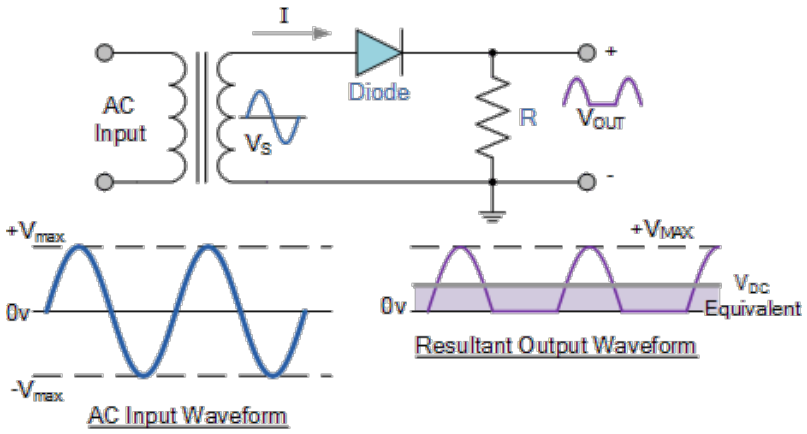
Power diodes can be used individually as above or connected together to produce a variety of rectifier circuits such as “Half-Wave”, “Full-Wave” or as “Bridge Rectifiers”.

## Half Wave Rectification

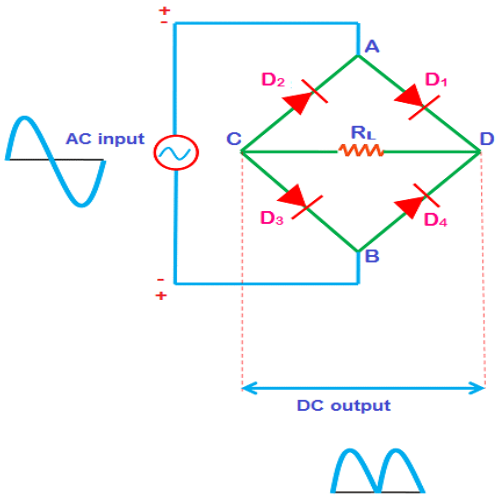



A rectifier is a circuit which converts the *Alternating Current* (AC) input power into a *Direct Current* (DC) output power. The input power supply may be either a single-phase or a multi-phase supply with the simplest of all the rectifier circuits being that of the **Half Wave Rectifier**.

The power diode in a half wave rectifier circuit passes just one half of each complete sine wave of the AC supply in order 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 as shown.

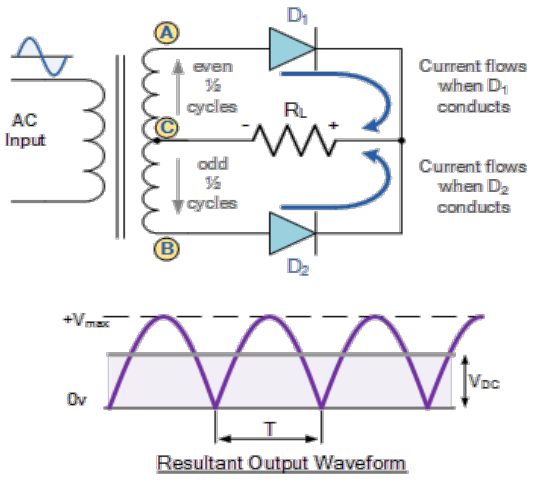



**Full Wave Rectifier Circuit**



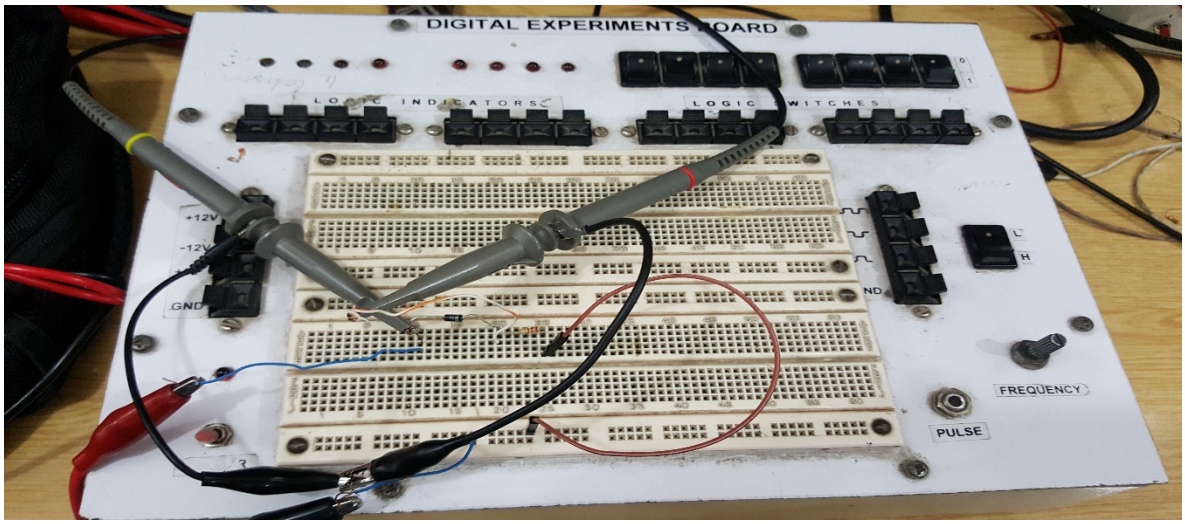

The full wave rectifier circuit consists of two *power diodes* connected to a single load resistance ($R_L$) with each diode taking it in turn to supply current to the load. When point A of the transformer is positive with respect to point C, diode $D_1$ conducts in the forward direction as indicated by the arrows.

When point B is positive (in the negative half of the cycle) with respect to point C, diode $D_2$ conducts in the forward direction and the current flowing through resistor R is in the same direction for both half-cycles. As the output voltage across the resistor R is the phasor sum of the two waveforms combined, this type of full wave rectifier circuit is also known as a “bi-phase” circuit.

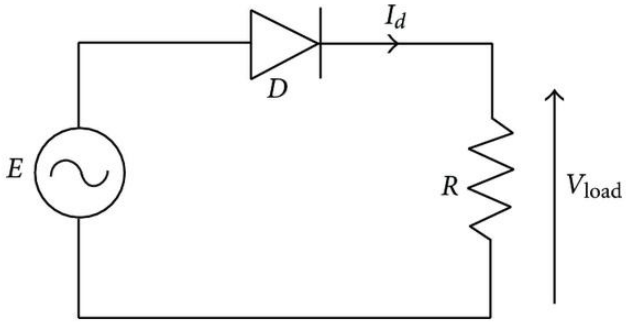


## Procedure

## Part 1




1. Construct the circuit of *Fig* . Record the measured values as well as calculated values.




## Results:

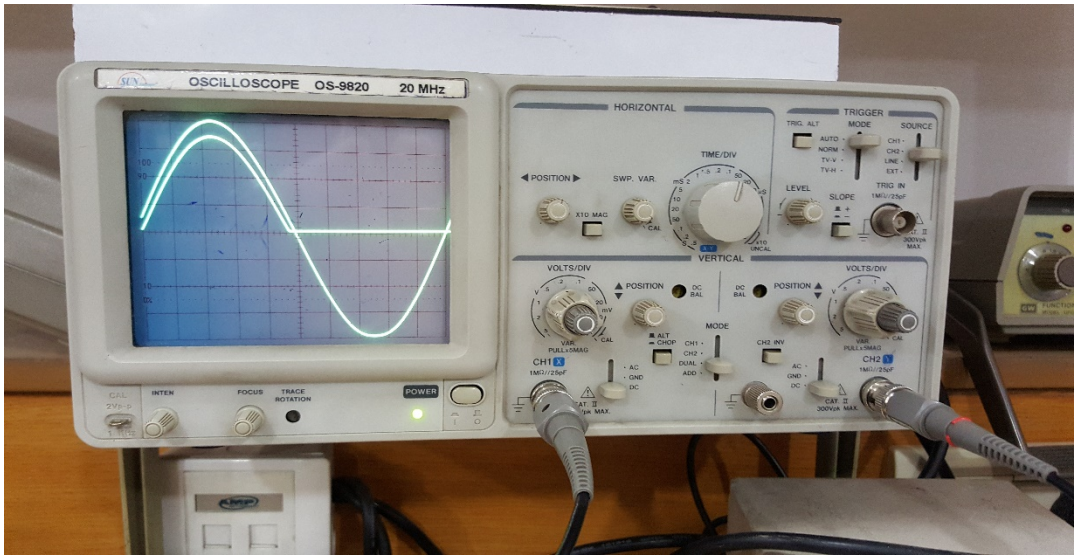
**Calculated:**

$V_T$ **= 0.49 V**

Voltage $V_D = \frac{Vm - VT}{\pi} = \frac{4 - 0.49}{\pi} = 1.117$ V

**Measured:**

Voltage $V_D$ = **1V**

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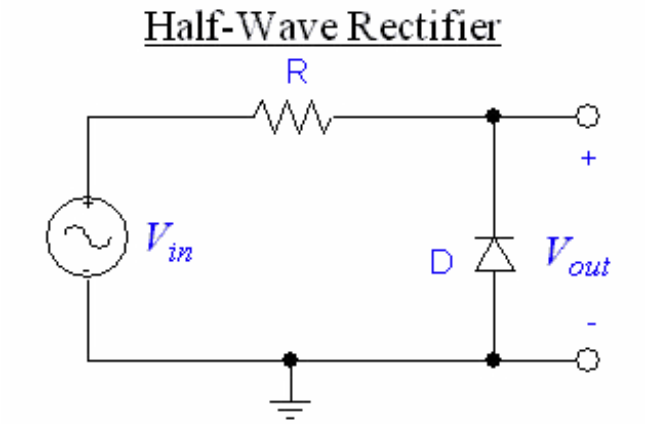
**Part 2:**

Construct the circuit of *Fig* . Record the measured values as well as calculated values.




## Results:

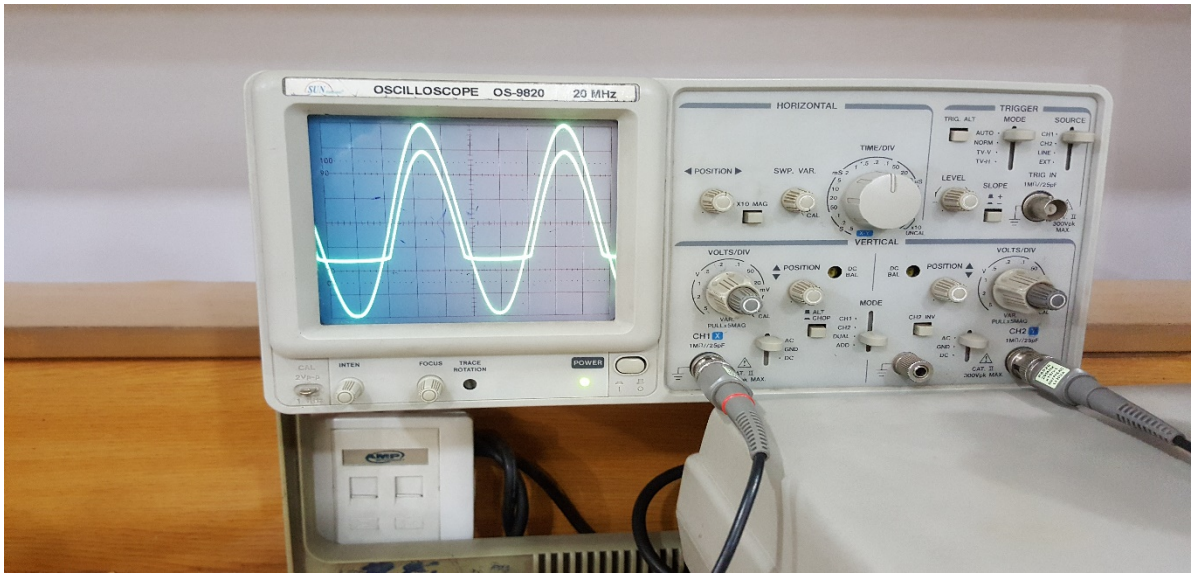
**Calculated:**

Voltage $V_{T1}$ = **0.51 V**

Voltage $V_D = \frac{Total\ Area}{2\pi} = \frac{Vm}{\pi} - \frac{Vt}{2} = 0.945$ V

**Measured:**

Voltage $V_D$ = **0.93 V**

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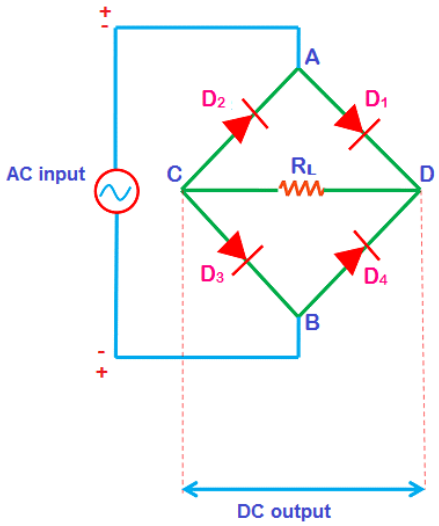
**Part 3:**

4. Construct the circuit of *Fig.* Record the measured as well as calculated values.




## Results:

**Calculated:**

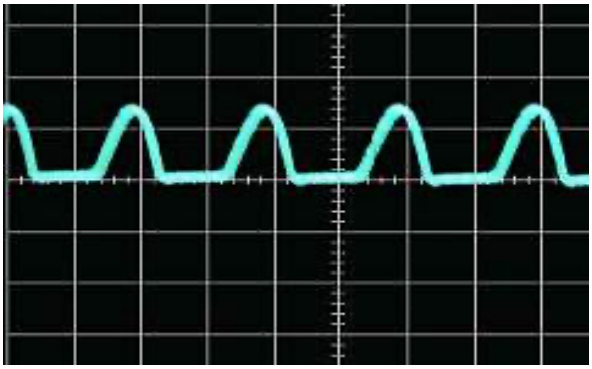
Voltage $V_T = \frac{VT1 + VT2 + VT3 + VT4}{4} = 0.495$ V

Resistance R = **2.2 kΩ**

Voltage $V_D = \frac{2}{\pi}(Vm - 2Vt) = 0.636\ (4 - 2(0.495)) = 1.91$ V

**Measured:**

Voltage $V_D$ = **1.58 V**



**Percentage Error:**

($V_{DC}$ **Cal -** $V_{DC}$ **Measured/** $V_{DC}$ **Cal) x 100 = 17.7 %**

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**Conclusion:**

Hence, we practically observed the behavior of diodes as rectifiers.

- In half wave rectification we saw that only half of every cycle of an alternating current is made to flow in one direction only.
- In full wave rectification we saw that it converted both half cycles of the AC signal into pulsating DC signal.

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