

**electronic Engineering Lab**

**Experiment #1**

**Diode characteristics and Applications**

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* ***Abstract:***

**General aim** of this experiment is to start using the electronic device such as diodes and to see what is the result of putting the diode in the circuit also what is the application of diodes .

**Mean Aim** : the aim for his experiment is :

1. To investigate the operation of pn junction ,and the VI characteristics of the silicon diode.
2. To investigate some applications of the p-n junction like rectification ,clamping and clipping.

* ***Theory :***

**Diode** is an electronic device with a single pn junction that have the ability to conduct current in one direction while blocking it the the other direction.

The equation of the forward current in the diode gives by:

Id=e^vd/vt(taw) -1 ……………………………(1)

In the knee voltage model :

When

Vs **>**0.7 the diode is on and Vd=0.7volt ………………………….(2)

Vs <0.7 the diode is off and replaced with short circuit ………………………..(3)

**Half wave rectification:**

Rectifier**:** its used to conver the ac voltage (zero-average value) into either positive or negative pulsating dc .

The output voltage after half wave rectifier given by:

Vo,avg=Vm-0.7/3.14 …………………………………..(4)

T and frequency will stay the same as the input voltage.

When adding a capacitor to the diode circuit that’s called the filter

**Filter**: used to smooth out the pulsating dc produced by the rectifier by removing its ac ripple .

Ripple factor(for half wave rectifier) 

**Full wave rectification(bridge):**

The output voltage afterbridge- full wave rectifier( is given by):

Vo,avg=2Vm-0.7/3.14……………………………………..(5)

T for this rectifier =1/2 To

F for this rectifier = 2 fo

Ripple factor(bridge-full wave rectifier)=



**Clipping circuit**:

The output voltage is part of the input but because of the variable voltage there is clipping in the output voltage.



**Clamping circuit**:  
when you change the variable voltage the output voltage will move vertically .



**Voltage multiplier circuit:**

Its gives multiple of the input voltage using capacitors and by measuring the voltage between two points .



* ***Procedure&calculations:***

Part 1:

1. The circuit of fig(1-1) was connected



1. The potentiometer was turned to zero ,fully anti clockwise
2. The power supply was switched on and adjusted to 5 volt.
3. The potentiometer was used to change the value of v ,from zero to 1 volt in 0.1v steps and in 0.5 steps from 1-3v.
4. The value of VR was measured .
5. VD and ID was calculated.

Part 2:

1. The circuit in fig(1-2) was connected.



1. The oscilloscope was switched on and the sinusoidal supply
2. T (period) was measured and recoded and the peak voltage too.
3. The dc and ac component were measured of the output voltage.
4. A capacitor was added to the circuit as its in fig(1-3)



1. The output waveform was observe on the oscilloscope also the peak-to-peak voltage was determined and the mean value too
2. Now 47uF capacitor was replaced in the place of 2.2uF capacitor.
3. The circuit in fig(1-4) was connected



2.the oscilloscope was connected to the output.

3.the dc and ac component were measured using DVM.

4.a 2.2uF capacitor was added to the circuit ,the output waveform was observed.

Part 3:

A.clipping

1. The circuit in fig (1-5) was connected.



2.the oscilloscope was connected to the output.

3.the power supply variable control was set to zero,the output waveform was sketched.

4.the dc source was increased slightly and it was noticed was happened.

1. Clamping
2. The circuit in fig(1-6) was connected



2.the steps before were followed as in the previous part.

1. Voltage multiplier circuit
2. The circuit ig fig(1-7) was set up.



2.the voltage between points a and b was measured using DVM.(doubler)

3. the voltage between points c and d was measured using DVM.(tripler)

4.the voltage across each capacitor was measured.

***Conclusion:***

we learned that diode is made from semiconductor material that create the pn junction.also We learned in this experiment how to deal with diode and what is the application of diode . there is a value of diode that if diode reach it ,he will start conduct current in the arrow way usually it 0.7 volt.

There is different type of diode one of them is rectifier ,also there is two kind of rectifier :half wave rectifier and full wave rectifier.

The half wave rectifier change the zero average signal to a pulsating dc with vo,avg=vm-0.7/3.14 ,while full wave have vo,avg=2vm-0.7/3.14.

When we add a capacitor to the circuit the filter start its job to smoot the signal to a dc and prevent the ac component as much as possible.

However we learnd how clipping circuit act ,and how the output waveform will be a part of the input signal but chopped off in some range (circuit consist of resistor and diode and variable source). The clamping circuit act as shifting the output waveform either positive or negative in they-axis(circuit consist of capacitor and diode and variable source). Finally voltage multiplier circuit its multiple the input voltage times(consist of numbers of capacitors and diodes each two in the opposite direction).in all cases we want to see what happened to the output waveform.