Experiment: 2
Diode rectifier circuits

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***Abstract*—This weeks experiment consisted of three primary parts. In first part, we aim at implementing a half-wave rectifier circuit by using AC signal and we analyzed the observation by plotting the input and output voltage on DSO. Our second aim was to implement a peak rectifier circuit by using a capacitor to the half wave rectifier circuit. In this Peak wave rectifier, we have to determine the conduction interval of the diode. Our third aim was to implement a shunt regulator using Zener Diode and we expected a DC output voltage on DSO by this circuit. Also we were required to analyze and than subsequently remove the various problems encountered in practical application of the rectifier circuits in the laboratory. Going through this experiment we encountered several unexpected results which we solved and analyzed by help of our instructor Hitesh sir and TAs.**

I. Introduction

A. Half-wave Rectifier

Half-Wave rectifier is a simple p-n junction connected in series with a resistor. It gives a half wave corresponding to the full AC input wave. (figure daalenge) In this figure, the input voltage is AC voltage.

B. Peak Rectifier

In peak rectifier a capacitor is connected in parallel of half wave rectifier's resistor. So in the reverse bias of diode, the capacitor gives voltage across to resistor and the output voltage's characteristics we can change by changing the RC value of the circuit.

C. Shunt Regulator

In Shunt regulator the output voltage of peak rectifier is gives to this given circuit and the minimum of output of peak rectifier should be greater than the cutoff voltage of zener diode. So that we can regulate the voltage. And we can have a output voltage most like DC.

II. Apparatus Required

A. Digital Storage Oscilloscope (DSO)-1

Agilent Technologies DSO1052B (50MHz,1GSa/s)

B. DFunction Generator-1

scientific SM5070 (3 MHz)

C. Bread Board

D. Oscilloscopic Probes with BNC Connector-3

One-X probe

E. Zener Diode-1

55C3V3

F. Resistor-3

G. Capacitor

$C_1 = 1000\mu f$

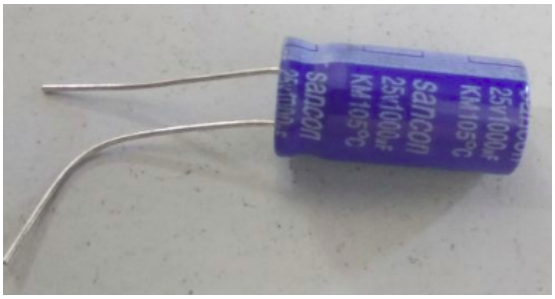

Fig. 1. capacitor

H. Some copper wire to have connection between circuit

III. Procedure

A. For Half Wave Rectifier

1) : We completed the circuit by connecting a diode and a Resistor in series.

2) : We gave the input voltage to the circuit by using function generator and 1X BNC probe.

3) : We took the output across the resistor and observed the wave in DSO.

4) : And we obtained half wave corresponding to the full AC input wave.

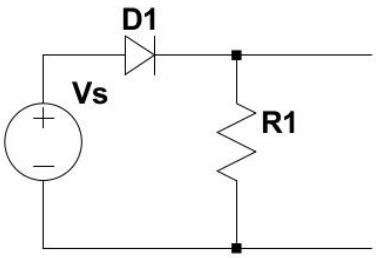

Fig. 2. Half-Wave Rectifier

B. *For Peak Rectifier(using Capacitor)*

1) : We make the circuit by using diode , capacitor and resistor as shown in figure.

2) : We give the Input voltage from the function generator by the 1X BNC probe.

3) : And we took the output across the resistor and we got output as we expected and this output depends on the RC value of our circuit.

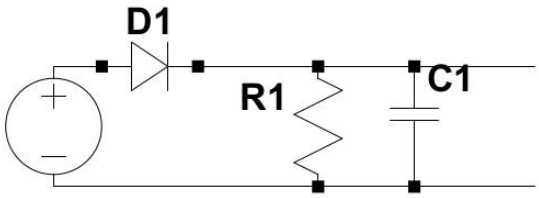

Fig. 3. Half-Wave Rectifier

C. *For Shunt Regulator*

1) : We gave the output of the peak rectifier(of above experiment) to the circuit of shunt regulator as shown in figure.

2) : we took the output of peak rectifier in channel-1 of DSO and the output of shunt regulator (across the Zener) in channel 2 and we found that the minimum voltage of the output of peak rectifier is less than the cutoff voltage of our zener diode.

3) : So our Instructor said us to give the DC offset so that our Input to the Shunt Regulator (output of peak rectifier) would greater than the cutoff voltage of given zener diode.

4) : After giving the DC offset we got out desired output.

IV. Experimental Results and Discussion

A. *For Half-wave Rectifier*

We got Half-wave with respect to the complete AC-signal.

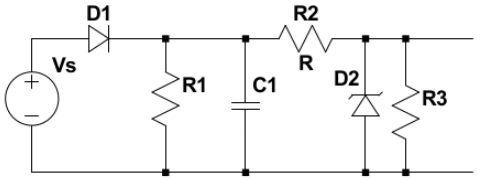

Fig. 4. Shunt Regulator Circuit.

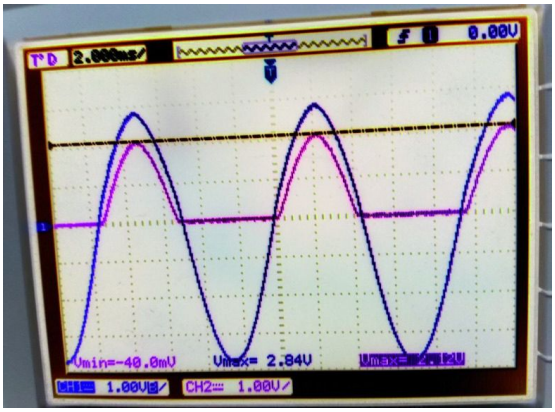

Fig. 5. Output of Half-Wave Rectifier Circuit(Voltage on Y-axis and T on X-axis)

$V_(maxinput) = 2.84V$ $V_(maxoutput) = 2.12V$
This difference of .72 voltage is because of inbuilt voltage of diode.

B. *For Peak Rectifier*

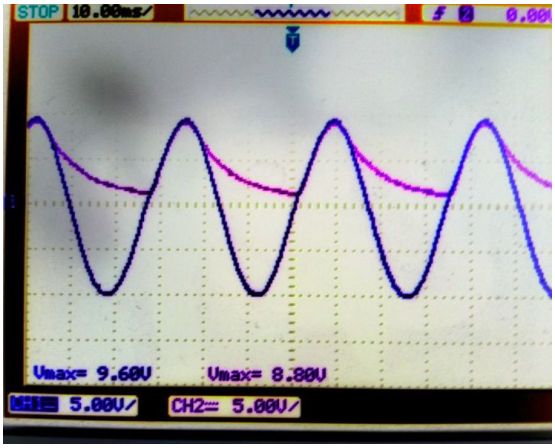

Fig. 6. Output of peak Rectifier Circuit(Voltage on Y-axis and T on X-axis)

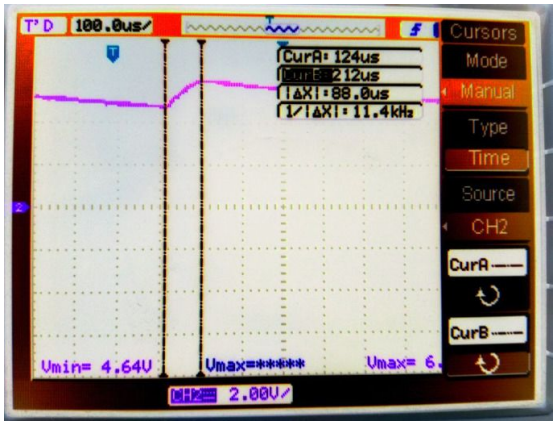

Fig. 7. conduction interval of peak rectifier(Voltage on Y-axis and T on X-axis)

we got conduction interval $88.0\mu s$

C. For Shunt Regulator

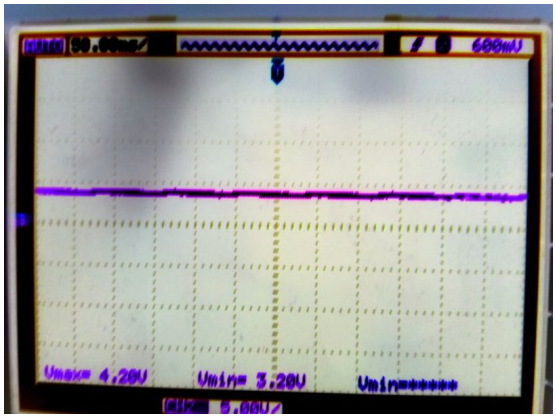

Fig. 8. Output of shunt regulator(Voltage on Y-axis and T on X-axis)

$V_(max) = 4.20V$ $V_(min) = 3.20Va$ We are expecting a output something like DC and we got it after giving DC offset to increase the minimum output voltage of peak rectifier.

V. PRECAUTION

A. Before using the prob cross check that probe con-figuration selected in DSO is the same as the probe using in the circuit (usually 1-X probe).

B. Do not allow the crocodile clips to touch each other.

C. Don't let touch your hand while measuring the resistor, it will give wrong result or measurement.

D. Select the DC coupling in DSO.

VI. CONCLUSION

It is concluded that in Half-wave rectifier we got the half -wave with a reduced magnitude and this is because of the inbuilt voltage.And the output of peak wave rectifier we can change by the changing the RC value and we can increase our DC characteristics by changing the value of RC.Moreover the circuit of shunt regulator can be further used in the charger of our laptop , mobile phones and DC supply.

REFERENCES

[1] Lecture Slides of Dr. Kunal Ghosh (Assistant Professor,IIT Mandi) and Instructions of Dr. Hitesh shirmali (Assistant Professor,IIT Mandi).
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[3] Circuits today, `http://www.circuitstoday.com/half-wave-rectifiers`