North South University

Department of Electrical & Computer Engineering

LAB REPORT - 02

Course Code: EEE111L

Course Title: ANALOG ELECTRONICS-I LAB

Section: 6

Lab Number: 02

Experiment Name:

Diode rectifier circuits.

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Submitted by Group Number:04

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Experiment Name: Diode rectifier circuits.

Objective:

In this lab, we have observed the functionality of a diode rectifier circuit. Also, we have explored numerous tensile strains to learn how it performs and which combination creates the most consumers.

Equipments and Components:

Serial No.	Component Details	Specification	Quantity
1	P-n junction diode	1N4007	4 piece
2	Resistor	10 kΩ	1 piece
3	Signal Generator		1 unit
4	Capacitor	0.22µF 10µF	1 piece each
5	Oscilloscope		1 Unit
6	Trainer Board		1 Unit
7	Chords and wire		As required

Theory:

Sometimes it might be necessary to convert an AC(Alternating Current) signal into a DC(Direct Current). This conversion is done by a rectifier. From lab one we already know that a diode only allows current flow if it is forward biasing. But the output of the diode can be changed depending on the alternative voltage. There are two types of main diode rectifiers:

(i) Half-Wave rectifier.

(ii)Full-wave rectifier.

Full wave rectifiers can be of another type. Which is a full-wave bridge rectifier. In the bridge rectifier four diodes are connected in a bridge formation.

(i) **Half-Wave Rectifier**:The voltage output of a half-wave rectifier is lower than that of a full-wave rectifier since it is constructed using only one diode. The negative signal is filtered out in this rectifier, resulting in a difference between the optimistic impulses.The efficiency of a half-wave rectifier is reduced, and the voltage supply is erratic.

(ii) **Full-wave rectifier:** A full-wave rectifier has a better output efficiency than a halfwave rectifier since it employs several diodes.Full-wave rectifiers come in two varieties.

(i) Full-wave rectifier using centre tapped transformer
(ii) Full-wave bridge rectifier

Circuit Diagram(s):

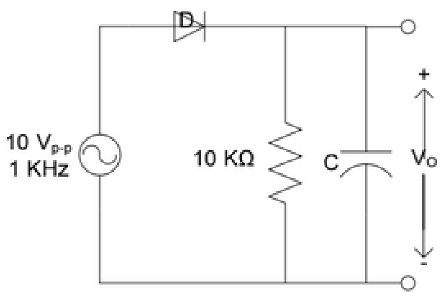

Figure 3.4 : Experimental Circuit 1.

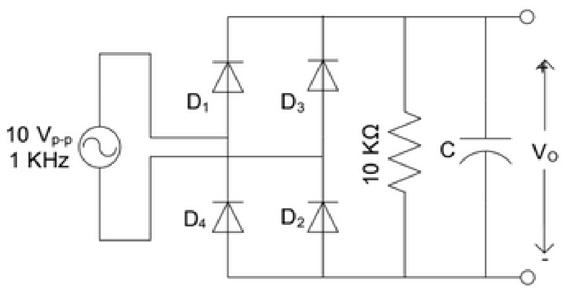

Figure 3.5 : Experimental Circuit 2.

Experimental procedure:

<u>For the half wave rectifier:</u>

we have built total of 3 circuits. The steps we followed were given below.

01. At first, we opened the Multisim software. Then we went to the "Place source" and selected the required component such as one Resistor(10KΩ), one p-n Junction Diode(1N4007), ground, function generator for the AC input and an oscilloscope for observing the output.

After building the circuit successfully, we observed the output signal which was half of the input signal.

02.Here we have added a capacitor additionally from the "place source". After the step 01, we have added 0.22µF capacitor parallelly to the resistor and observed the output by the "Analyses and simulation" procedure and observed the output.

03. After step 02, we just changed the value of capacitor from 0.22µF to 10µF and observed the output by the “Analyses and simulation” procedure.

<u>For the Full wave rectifier:</u>

we have built total of 3 circuits for this as well. The steps we followed were given below.

01. At first, we opened the Multisim software. Then we went to the “Place source” and selected the required component such as one Resistor(10KΩ), **four** p-n Junction Diode(1N4007), ground and function generator for the AC input.

After building the circuit successfully, we observed the output signal which was full of the input signal.

02.Here we have added a capacitor additionally from the “place source”. After the step 01, we have added 0.22µF capacitor parallelly to the resistor and observed the output by the “Analyses and simulation” procedure and observed the output.

03. After step 02, we just changed the value of capacitor from 0.22µF to 10µF and observed the output by the “Analyses and simulation” procedure.

Result and Analysis:

We used a diode rectifier to convert AC signals to DC in this experiment. The components and circuit design are switched numerous times to find out what's going on and which circuit and components produce the greatest results. Diodes, signal generators, oscilloscopes, resistors, and capacitors are the primary components of this experiment. The findings and the overall existence of multiple rectifiers are reported once they are built. There are two sorts of diode rectifiers when it comes to circuit design. The half-wave rectifier and the full-wave converter are the two types of rectifiers. We further say that a half-wave rectifier is less efficient than a full-wave rectifier in this investigation. The final voltage signal is chopped in half in the graph of the half-wave rectifier, resulting in an erratic supply. A capacitor's role is to smooth out rippling signals, resulting in a much smoother signal. In two distinct circuits of the half-wave rectifier, 0.22μF and 10F capacitors are utilized. The graph of the circuit with 10μF produced considerably smoother signals than the other one, as observed from the graph. The performance of a full-wave bridge rectifier without a capacitor, on the other hand, is similar to that of a half-wave diode with a 0.22μF capacitor. A further two circuits use 0.22F and 10F capacitors, respectively, and both provide a smooth Voltage output. Finally, we can state that a full-wave bridge rectifier with a capacitor should be the preferred option for every appliance.

By implementing rectifiers via capacitors, we learned about two types of rectifiers. By simulating the half-wave and full-wave rectifiers, we saw how a capacitor could lower the ripple rate of signals in DC. The simulation part was a bit difficult to understand. But after some trial and error, it finally worked as intended.

Questions and Answers:

1. Write the answers that were asked during the working procedure.

Answer:

<u>For the half wave rectifier:</u>

we have built total of 3 circuits. The steps we followed were given below.

01. At first, we opened the Multisim software. Then we went to the "Place source" and selected the required component such as one Resistor(10KΩ), one p-n Junction Diode(1N4007), ground, function generator for the AC input and an oscilloscope for observing the output.

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For the Full wave rectifier:

we have built total of 3 circuits for this as well. The steps we followed were given below.

01. At first, we opened the Multisim software. Then we went to the “Place source” and selected the required component such as one Resistor(10KΩ), **four** p-n Junction Diode(1N4007), ground and function generator for the AC input.
After building the circuit successfully, we observed the output signal which was full of the input signal.

02.Here we have added a capacitor additionally from the “place source”. After the step 01, we have added 0.22µF capacitor parallelly to the resistor and observed the output by the “Analyses and simulation” procedure and observed the output.

03. After step 02, we just changed the value of capacitor from 0.22µF to 10µF and observed the output by the “Analyses and simulation” procedure.

2. Draw the input wave, output wave (without and with capacitor) for both the circuits.

Answer:

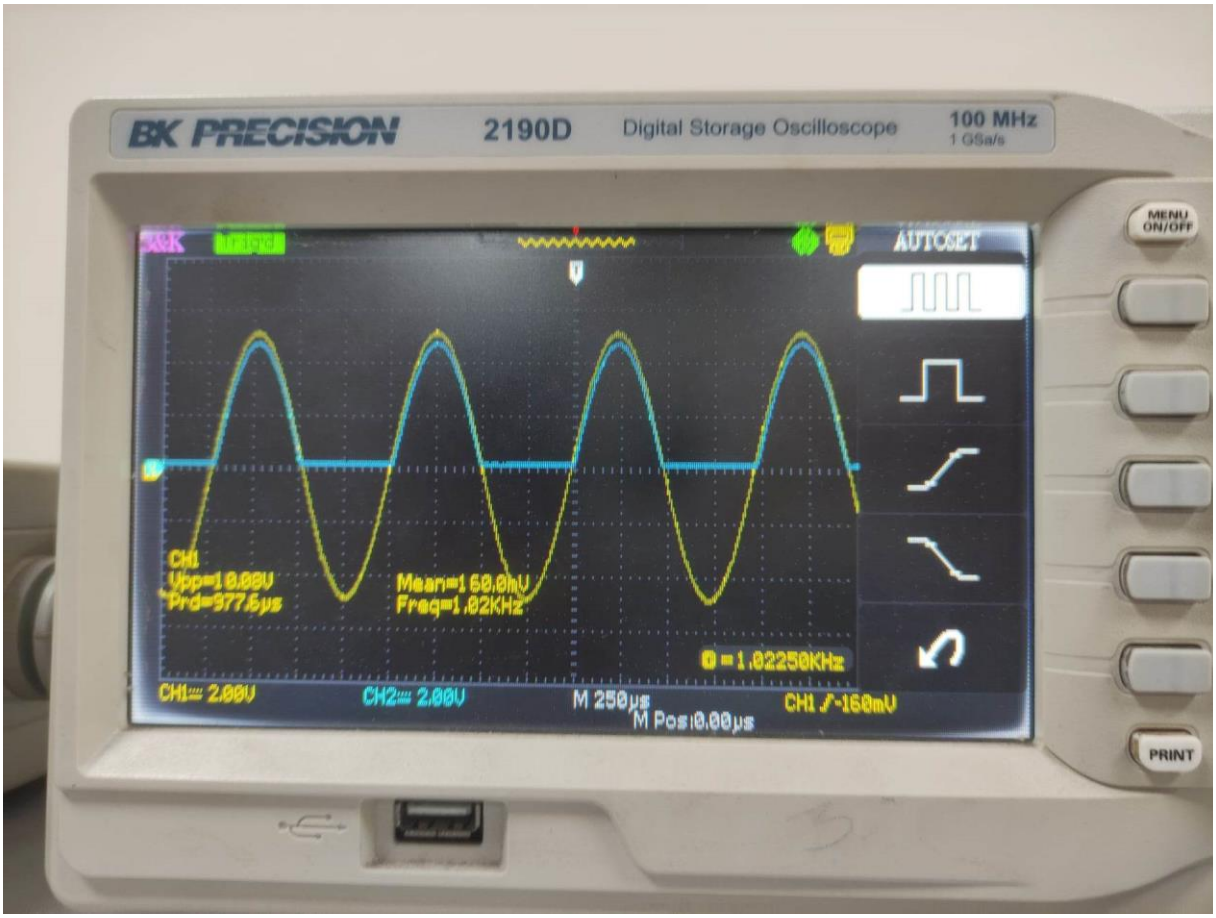

Fig: Graph of half-Wave Rectifier without Capacitor

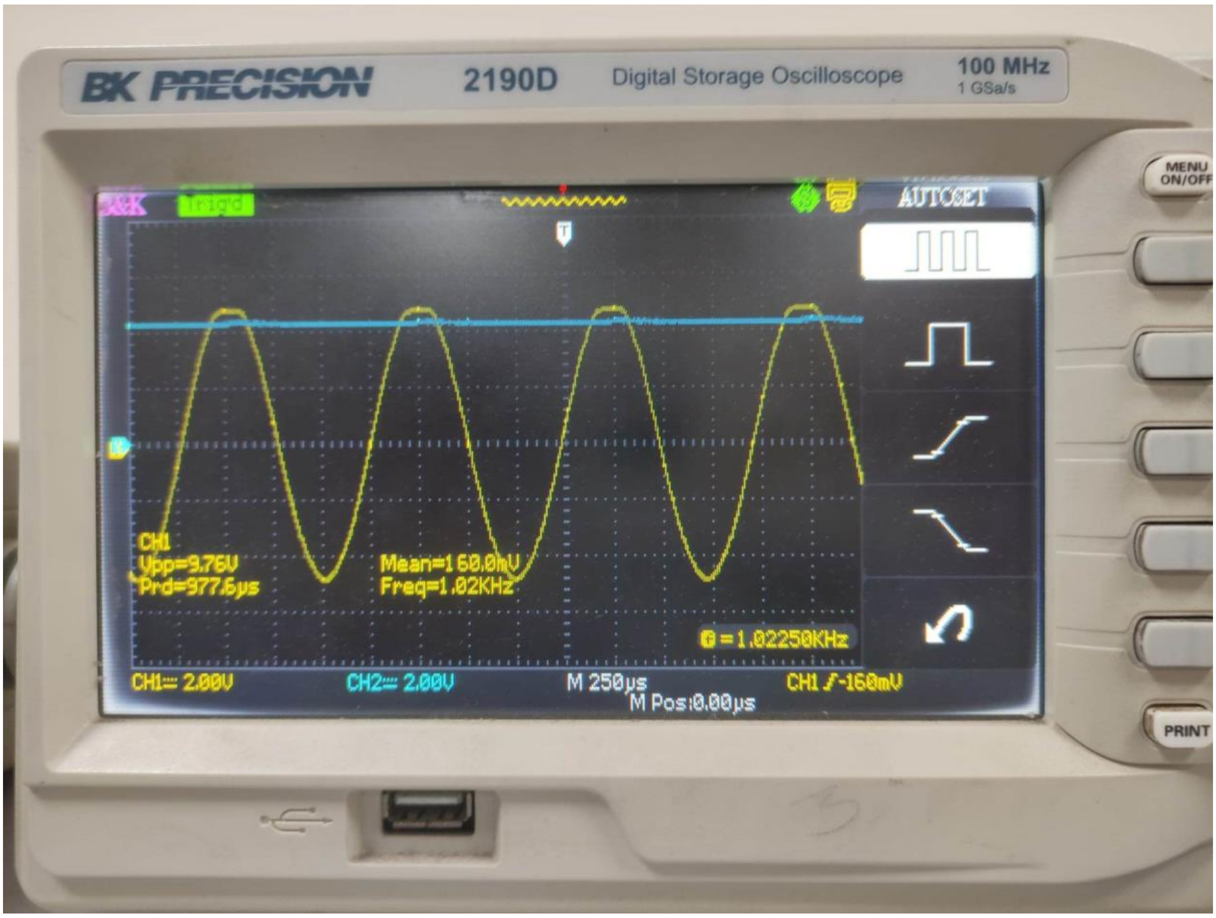

Fig:Graph of Half-Wave Rectifier with 0.22µF Capacitor.

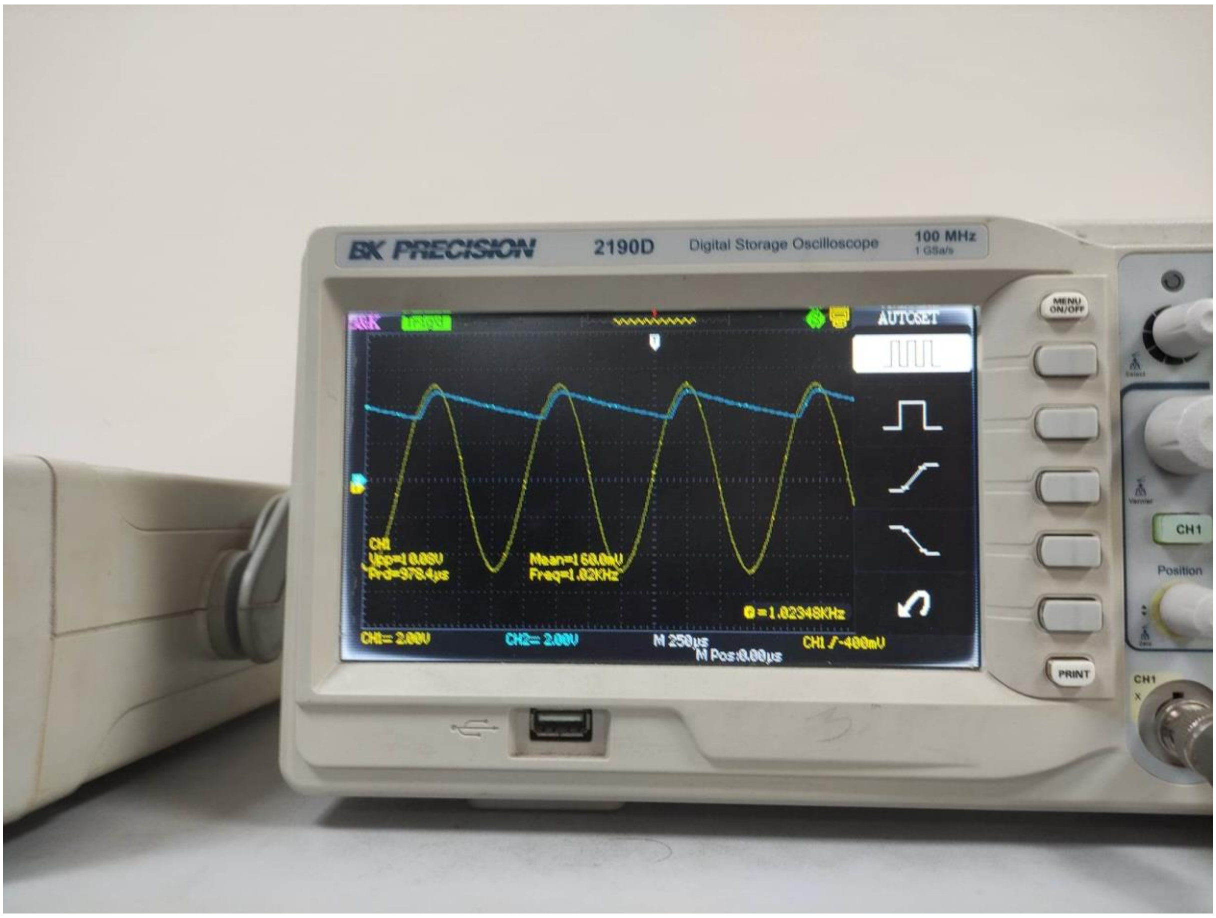

Fig: Graph of Half-Wave Rectifier with 10µF Capacitor.

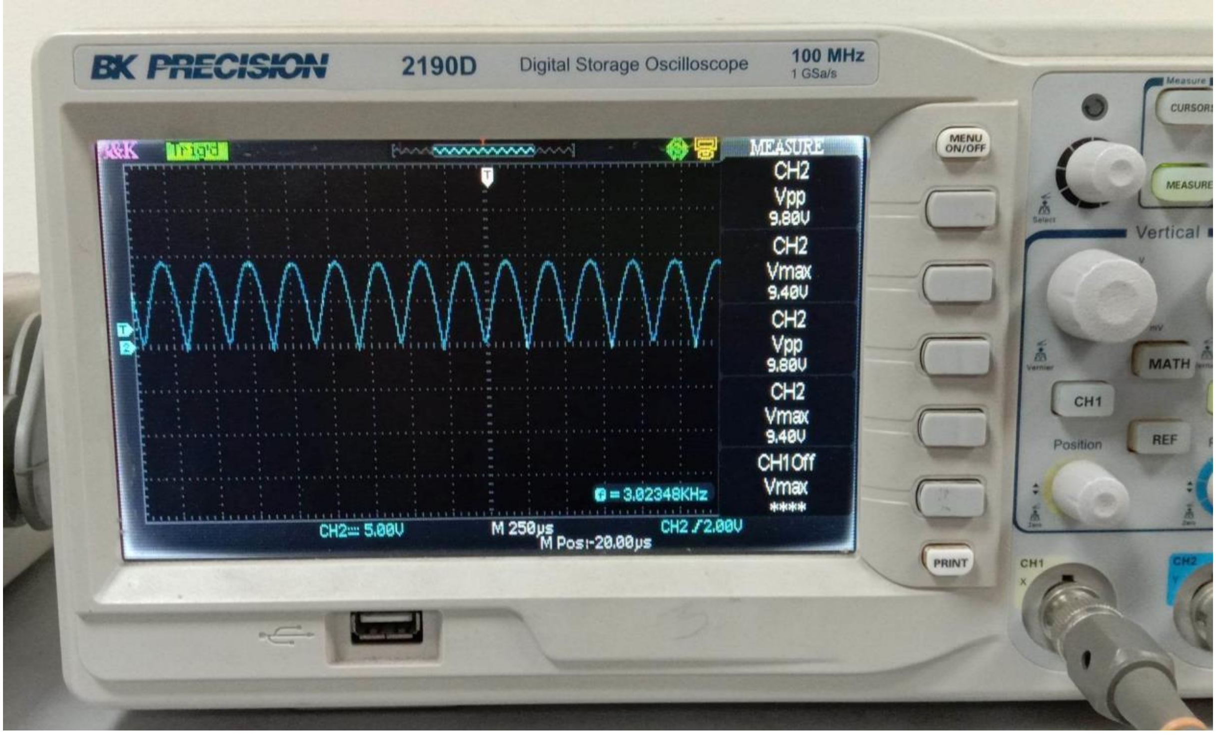

Fig: Graph of Full-Wave Rectifier without Capacitor.

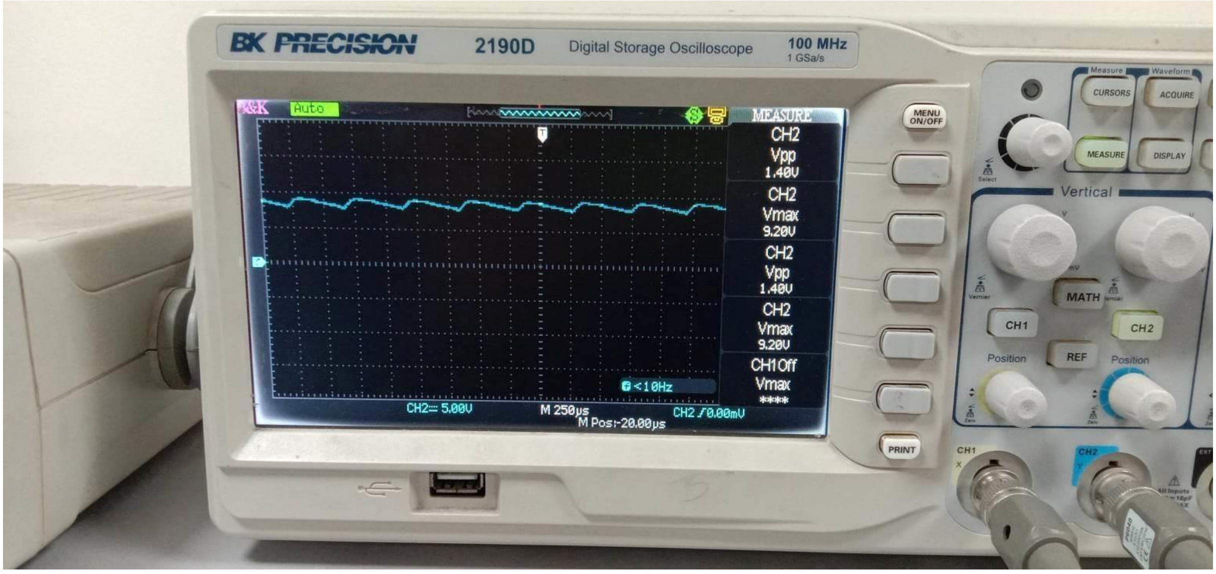

Fig: Graph of Full-Wave Rectifier with 0.22μF Capacitor

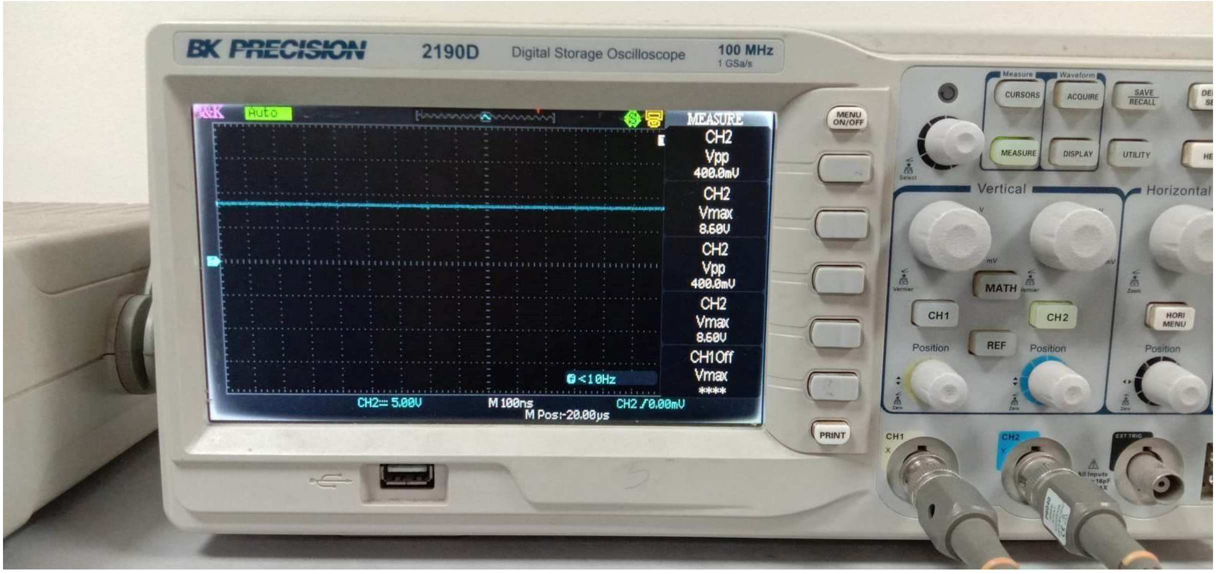

Fig: Graph of Full-Wave Rectifier with 10μF Capacitor

3. What is the effect in output for changing input signal frequency for both the circuits(without and with capacitor)?

Answer: The output signal is affected by changes in frequency in the input signal. The output signal ripples more frequently as the frequency of the input signal rises, and vice versa.

4. What is the function of capacitor in the both circuits? Why a capacitor of higher value is preferable?

Answer: The capacitor works as a filter in bth circuits.The capacitor reduces the singnal in the output voltage ans also increase the average voltage of the output which helps to get a clear DC output.The singnal of a output voltage reduces. Therefore, a capacitor of higher value is preferable for the filtaring of the output voltage.