3. HALF WAVE RECTIFIER

Aim: To determine the output wave form of Half-wave rectifier

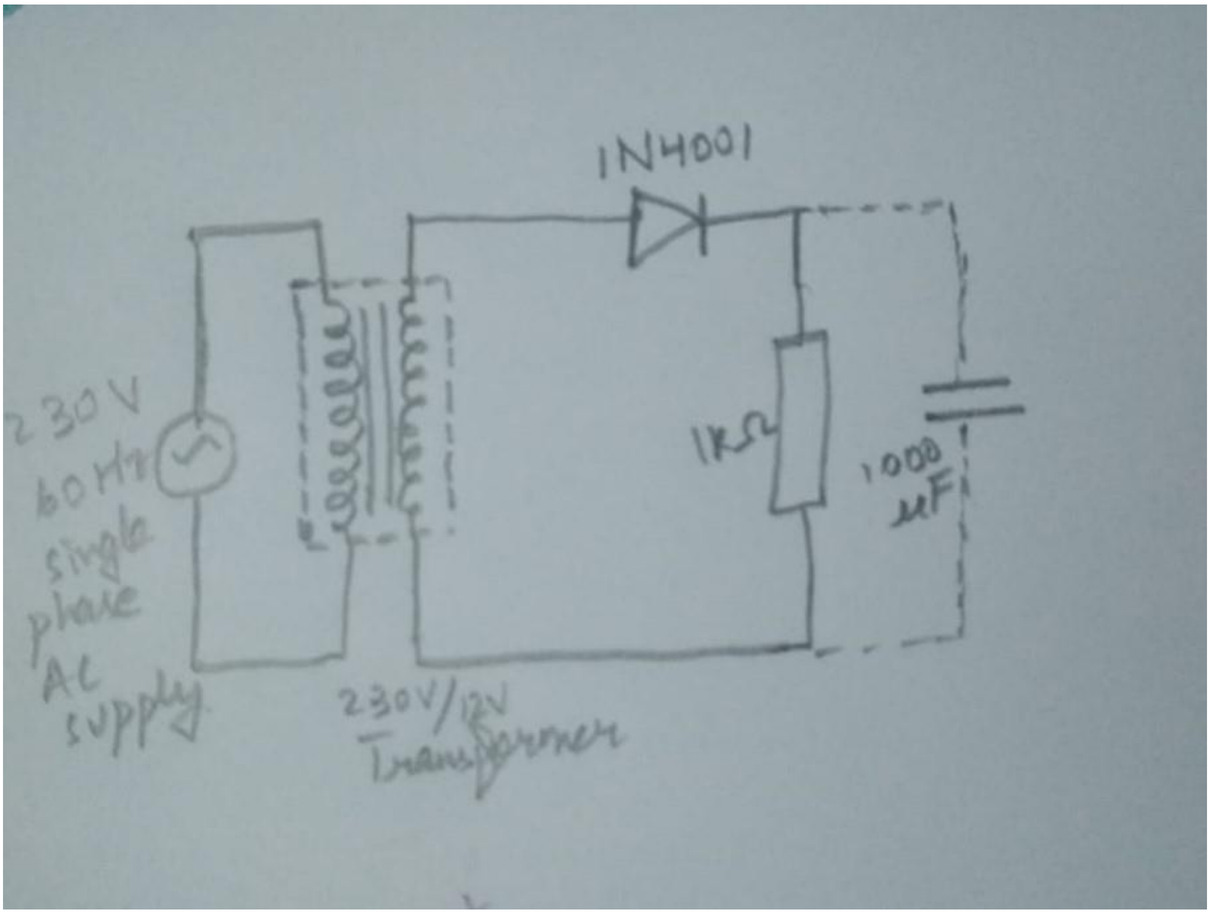
Theory: The process of converting the AC into DC is called rectification and it is obtained through rectifier circuits, which use diodes as circuit element. For a half wave rectifier during the positive half cycle, the diode is forward biased and it conducts and hence a current flows through the load resistor. During the negative 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 for one half cycles and results in a half wave rectified output.

A Full wave rectifier is a circuit, which converts an AC voltage into a pulsating dc voltage using both half cycles of the applied voltage. It uses two diodes of which one conducts during one half cycle while the other conducts during the other half cycle of the applied ac voltage. During the positive cycle of the input voltage, diode D1 becomes forward biased and D2 becomes reverse biased. Hence D1 conducts and D2 remains off. The load current flows through D1 and the voltage drop across RL will be equal to the input voltage. During negative half cycle of the input voltage, diode D1 becomes reverse biased and D2 becomes forward biased. Hence D1 remains off and D2 conducts. The load current flows through D2 and the voltage drop across RL will be equal to the input voltage.

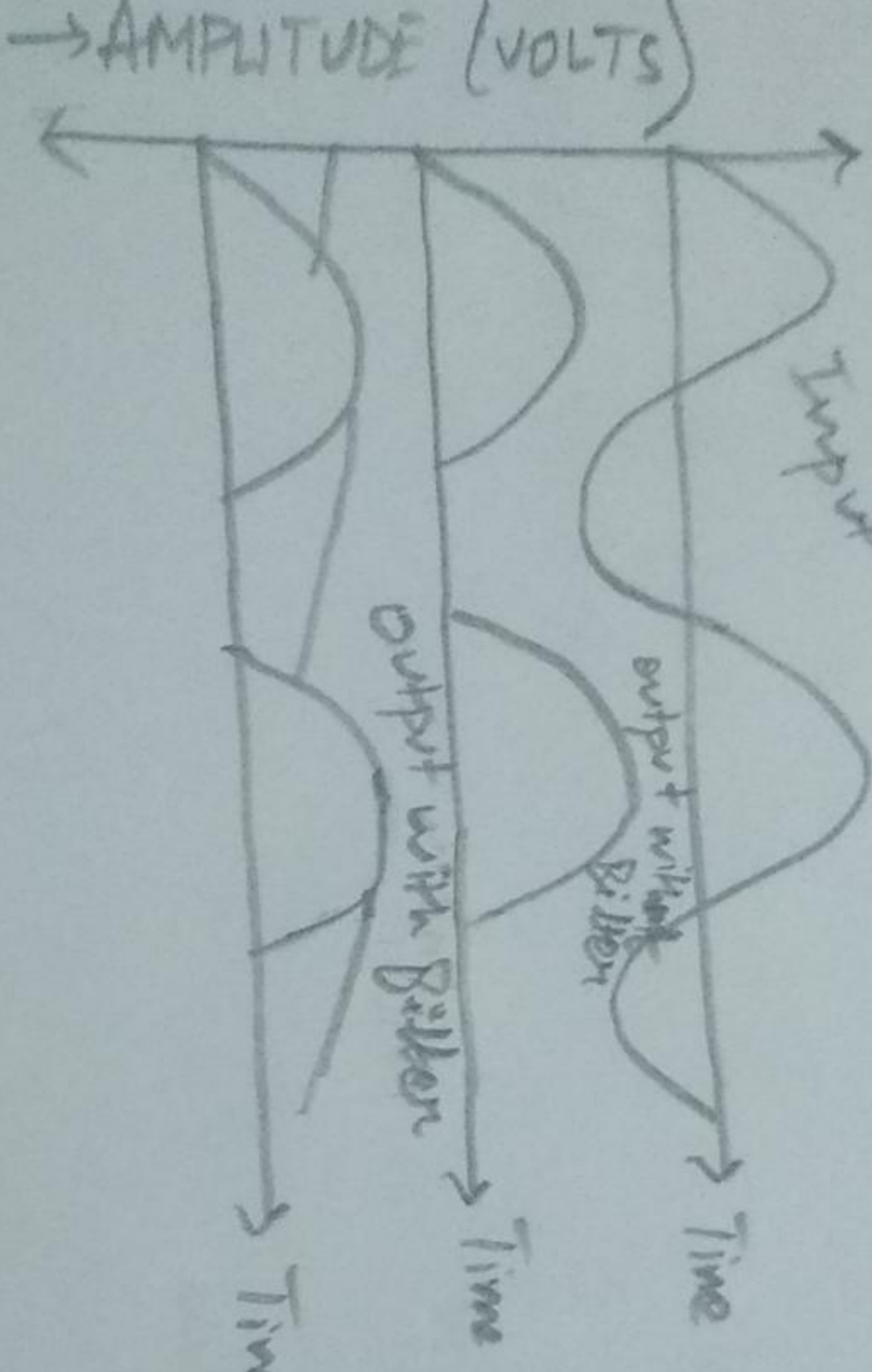
To obtain a pure DC voltage at the output, filtering is done where the AC is removed and the DC is obtained. For that capacitor is used as a filter. We can connect a high value capacitor in shunt with the load. The capacitor offers a low impedance path to the ac components of current. Most of the ac current passes through the shunt capacitor. All the dc current passes through the load resistor. The capacitor tries to maintain the output voltage constant at Vm. The practical application of any rectifier (be it half wave or full wave) is to be used as a component in building DC power supplies. In order to build an efficient & smooth DC power supply, a full wave rectifier is always preferred. However, for applications in which a constant DC voltage is not very essential, we can use power supplies with half wave rectifier.

Components Required:

Half wave Rectifier:



Model graph:


→AMPLITUDE (VOLTS)
Input
output without filter
output with filter
Time
Time
Time

Procedure:

1. Connect the components as mentioned below: L1-L7, L3-L7, L4-L5,L5-L8,L12-L6,L8-L9.

2. Click on ‘Check connection’ button to check the connections.

3. If connected wrong, double click on the wrong connection. Else click on ‘Delete all connection’ button to erase all the connections.

4. Set the resistor RL.

5. Double click on ‘ON’ button to start the experiment.

6. Click on ‘sine wave’ button to generate input waveform.

7. Click on ‘Oscilloscope’ button to get the rectified output.

8. Vary the amplitude, frequency, volt/div using the controllers.

9. Click on “dual” button to observe both waveform. 10. Channel 1 shows the input sine waveform, Channel 2 shows the output rectified waveform.

11. Calculate the Ripple Factor. Theoretical Ripple Factor =1.21.

12. Note: Read the Virtual oscilloscope tutorial provided at the bottom.

Calculations:

$V_m = 1.2V$ (Amplitude) = peak voltage

$V_{rms} = \frac{1.2}{2} = 0.6$.

$V_{dc} = \frac{1.2}{\pi} = 0.381$.

$V_{ac} = \sqrt{(V_{rms}^2 - V_{dc}^2)} = \sqrt{0.36 - 0.145} = 0.46$.

Ripple factor $= \frac{V_{ac}}{V_{dc}} = \frac{0.46}{0.38} = 1.21$

Peak current $= 0.99$ mA.

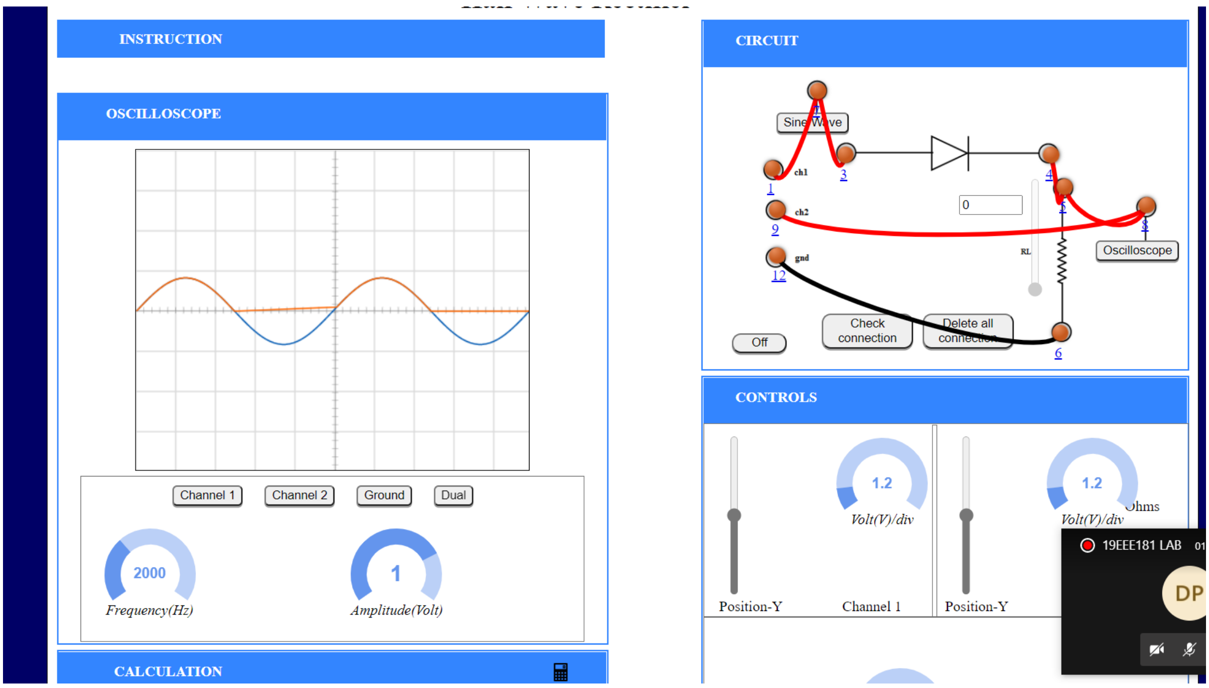
Result:

By this experiment we determined the output wave form of half wave rectifier.

Interference:

A half wave rectifier is not as effective as a full wave rectifier. With a ½ wave, we are throwing away one hump of the sine wave, either positive or negative portion. With a full wave rectifier we get both humps either positive or negative.

The resultant effective voltage is much greater with a full wave rectifier, because there is very little time when the voltage is zero. The half wave is zero for ½ of the cycle.


INSTRUCTION
OSCILLOSCOPE
Channel 1
Channel 2
Ground
Dual
2000
Frequency(Hz)
1
Amplitude(Volt)
CALCULATION
CIRCUIT
Sine Wave
ch1
ch2
gnd
1
3
9
12
4
5
8
6
0
RL
Oscilloscope
Off
Check connection
Delete all connection
CONTROLS
1.2
Volt(V)/div
Position-Y
Channel 1
1.2
Volt(V)/div
Ohms
Position-Y
19EEE181 LAB
DP