DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603203.

Title of Experiment	: **Wave shaping circuits (Half wave & Full Rectifiers)**
Name of the candidate	: Arnav shukla
Register Number	: RA2111050010001
Date of Experiment	: 18-10-2021
Date of submission	**:** 25-10-2021

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
Total		**50**	

Staff Signature

PRE LAB QUESTIONS (Rectifiers)

1 What is the necessity of rectifier?

Answer: Using a rectifier in the power supply **helps in converting AC to DC power supply**. Bridge rectifiers are widely used for large appliances, where they are capable of converting high AC voltage to low DC voltage.

2 What is PIV of a diode in Full Wave Rectifier (FWR) and Half Wave Rectifier (HWR)?

Answer: PIV: The peak inverse voltage (PIV) is **the maximum reverse voltage the diode should withstand without breakdown**. Rectifier (FWR) and the PIV of the diodes to be used. The diode D1 is reverse biased and acts as open. The diode D2 is forward biased and acts as a short.

3 What is ripple factor? Why it is required?

Answer: Ripple factor is defined as. **The ratio of RMS value of an alternating current component in the rectified output to the average value of rectified output**. The ripple factor is denoted as γ. It is a dimensionless quantity and always has a value less than unity.

When the fluctuation occurs within the output of the rectifier then it is known as ripple. So this factor is **essential to measure the rate of fluctuation within the resolved output**. The ripple within output voltage can be reduced by using filters like capacitive or another kind of filter.

4 Why are filters connected at the output of rectifiers?

Answer: A filter circuit is a **device that removes ac component of rectifier output but allows the dc component to reach the load**. The filter circuit is installed between the rectifier and the load.

Even though the full wave rectifier rectify both positive and negative half cycles, the DC signal obtained at the output still contains some ripples. To reduce these ripples at the output, we use a filter. The filter is **an electronic device that converts the pulsating Direct Current into pure Direct Current**.

5 What are the types of filters used in rectifier? And which is better and why?
Types of filters

Answer: Rectifiers are those circuit which provide DC as output but even if you use Bridge rectifier the output will have some AC component along with DC component.

So In order to reduce the AC component we will be using different types of filter at the output side of the rectifier.

So these filters are consist of **Inductors** and **capacitor**.

1.Inductor: It is connected in series in filter circuit because Inductors have inductive reactance which is a opposition to any changes and hence it offers high impedance to AC and and low to DC because DC is a constant signal and AC will be keep on varying wrt time.

2. Capacitor: capacitor is connected in parallel in the filter circuit as the capacitor blocks DC and allows AC. So any AC component in the output will pass through the capacitor to the ground and we get less amount of ac in the output.**Note: charged capacitor blocks DC and allow AC.**

Depending upon on the placement of inductor and capacitors we can have **L - Section filter** which consists of one inductor in series and capacitor in parallel and **pi section filter** which consists of 2 capacitor in Parallel along with inductor in between connected in series. **The preferred one in pi section filter**.

Date :	SINGLE PHASE HALF WAVE RECTIFIER

Aim

To construct a half wave rectifier using diode and to draw its performance characteristics.

Apparatus Required

S. No.	Name	Range	Qty
1	Transformer	230/(6-0-6)V	1
2	R.P.S	(0-30)V	2

Components Required

S. No.	Name	Range	Qty
1	Diode	IN4007	1
2	Resistor	1K Ω	1
3	Bread Board	-	1
4	Capacitor	100µf	1
5	CRO	-	1

Formulae

With out Filter

(i) V_{rms} = $V_m / 2$

(ii) V_{dc} = $V_m / \prod$

(iii) Ripple Factor = $\sqrt{((V_{rms} / V_{dc})^2 - 1)}$

(iv) Efficiency = $(V_{dc} / V_{rms})^2 \times 100$

With Filter

(i) V_{rms} = $\sqrt{(V_{rms}^2 + V_{dc}^2)}$

(ii) V_{rms} = $V_{rpp} / (\sqrt{3} \times 2)$

(iii) V_{dc} = $V_{m -} V_{rpp} / 2$

(iv) Ripple Factor = V_{rms} / V_{dc}

Procedure

Without Filter

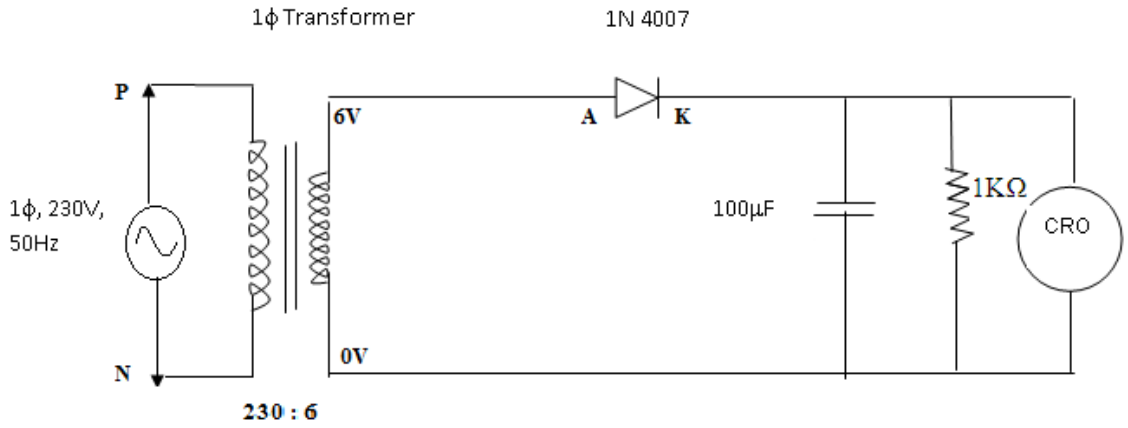
1. Give the connections as per the circuit diagram.
2. Give 230v, 50HZ I/P to the step down TFR where secondary connected to the Rectifier I/P.
3. Take the rectifier output across the Load.

4. Plot its performance graph.

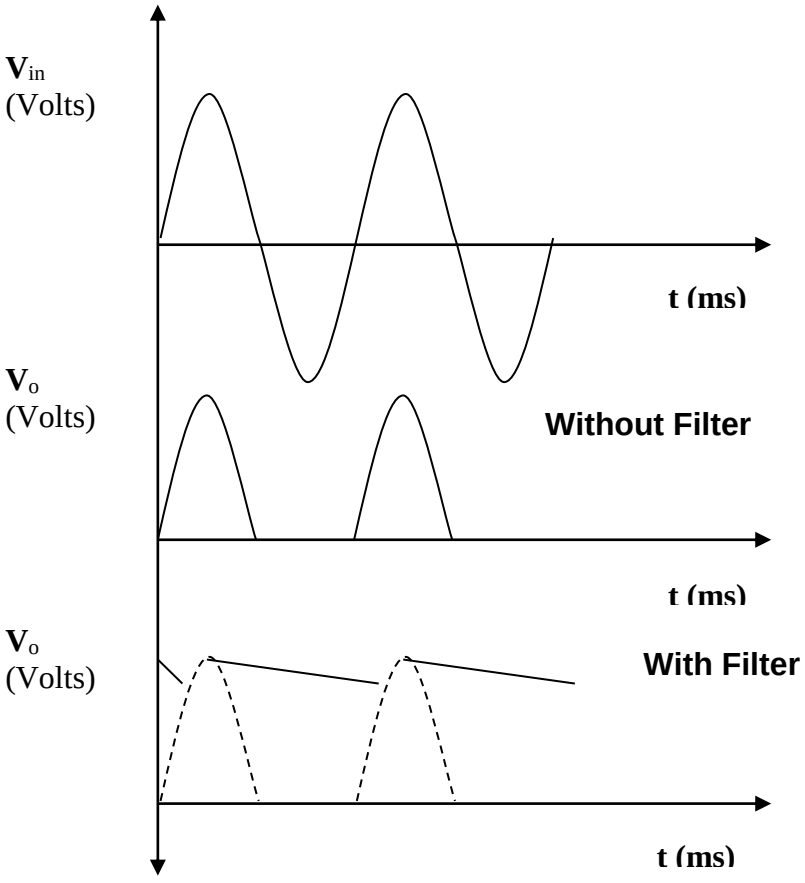
With Filter

1. Give the connections as per the circuit diagram.
2. Give 230v, 50HZ I/P to the step down TFR where secondary connected to the Rectifier I/P.
3. Connect the Capacitor across the Load.
4. Take the rectifier output across the Load.
5. Plot its performance graph.

Circuit Diagram



Model Graph



Tabular Column

Without Filter

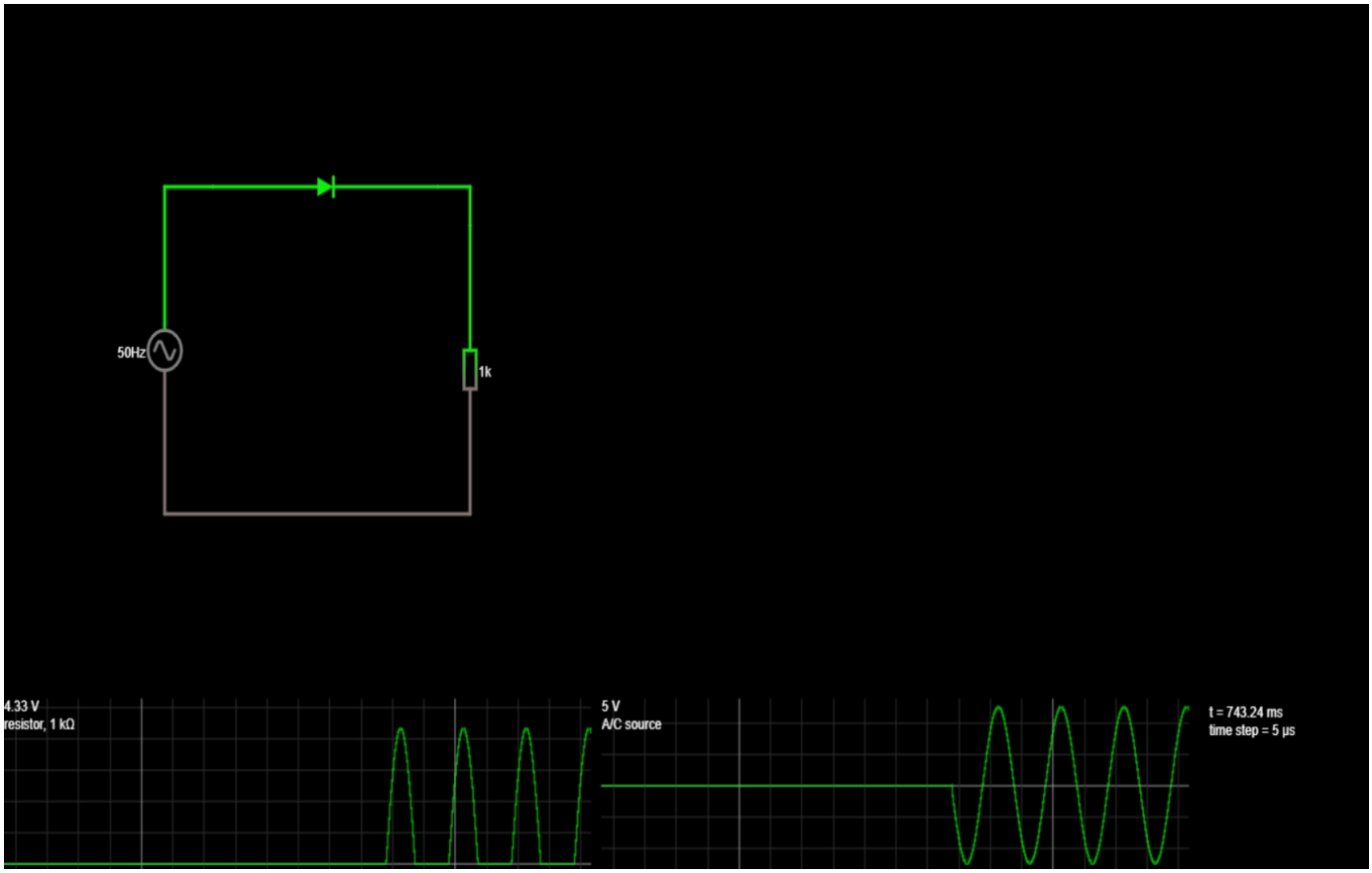
V_m (V)	V_{rms} (V)	V_{dc} (V)	Ripple factor	Efficiency
4.33	2.165	1.378	1.468	40.5

With Filter

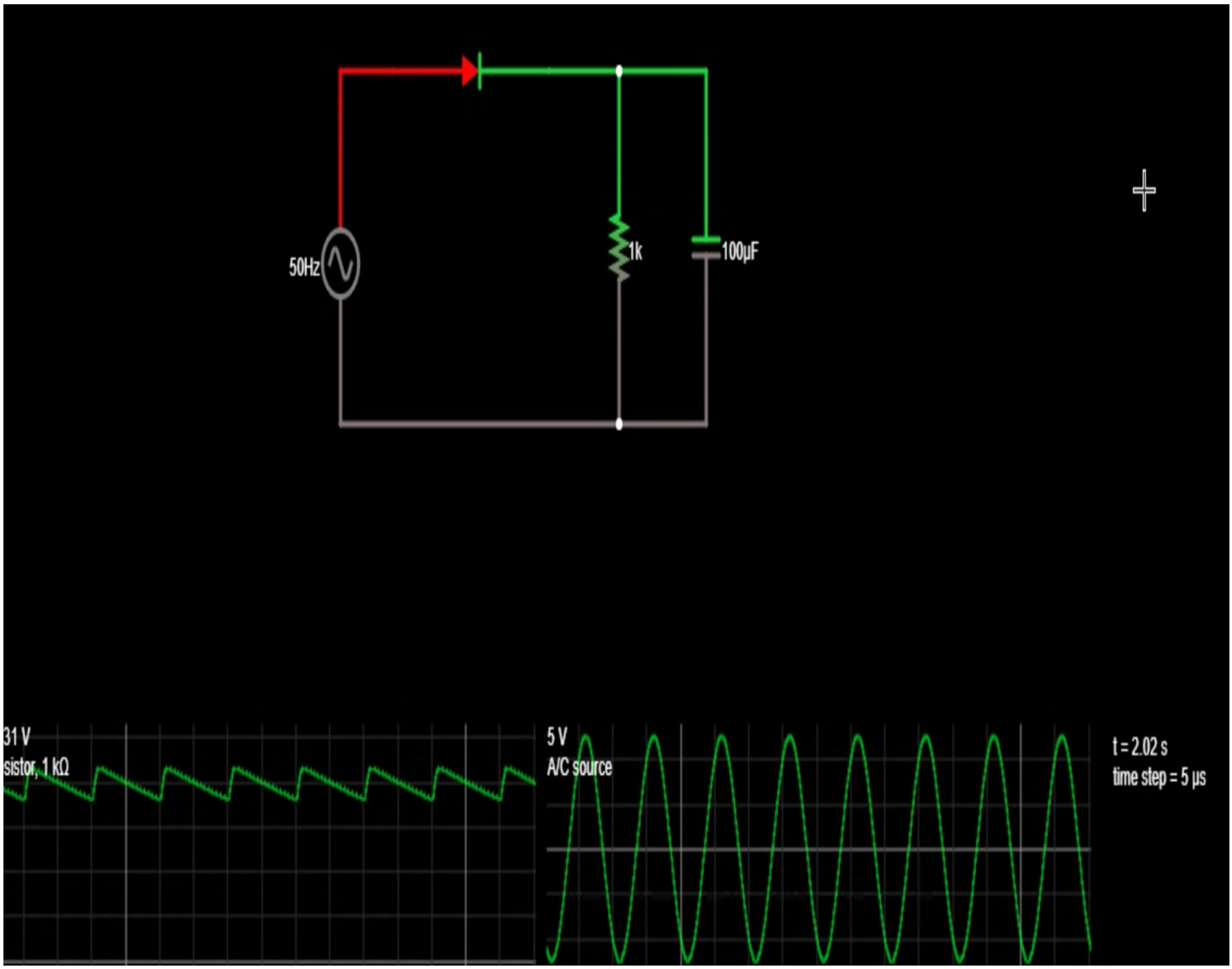
V_{rpp} (V)	V_{rms} (V)	V_{dc} (V)	Ripple factor
4.31-3.62=0.69	0.199	3.985	0.0499

Simultion Diagram:

a) **Without filter**



b)With filter



Result:

Half Wave Rectifier using diode was constructed and its performance was plotted in the table

Date :	SINGLE PHASE FULL WAVE RECTIFIER

Aim

To construct a single phase full-wave rectifier using diode and to draw its performance characteristics.

Apparatus Required

S. No.	Name	Range	Qty
1	Transformer	230/(6-0-6)V	1
2	R.P.S	(0-30)V	2

Components Required

S. No.	Name	Range	Qty
1	Diode	IN4007	2
2	Resistor	1K Ω	1
3	Bread Board	-	1
4	Capacitor	100µf	1
5	CRO	1Hz-20MHz	1
6	Connecting wires	-	Req

Formulae

Without Filter

(i) $V_{rms} = V_m / \sqrt{2}$

(ii) $V_{dc} = 2V_m / \prod$

(iii) Ripple Factor $= \sqrt{((V_{rms} / V_{dc})^2 - 1)}$

(iv) Efficiency $= (V_{dc} / V_{rms})^2 \times 100$

With Filter

(i) $V_{rms} = V_{rpp} /(2*\sqrt{3})$

(ii) $V_{dc} = V_{m} - V_{rpp}$

(iv) Ripple Factor $= V_{rms'/} V_{dc}$

Procedure

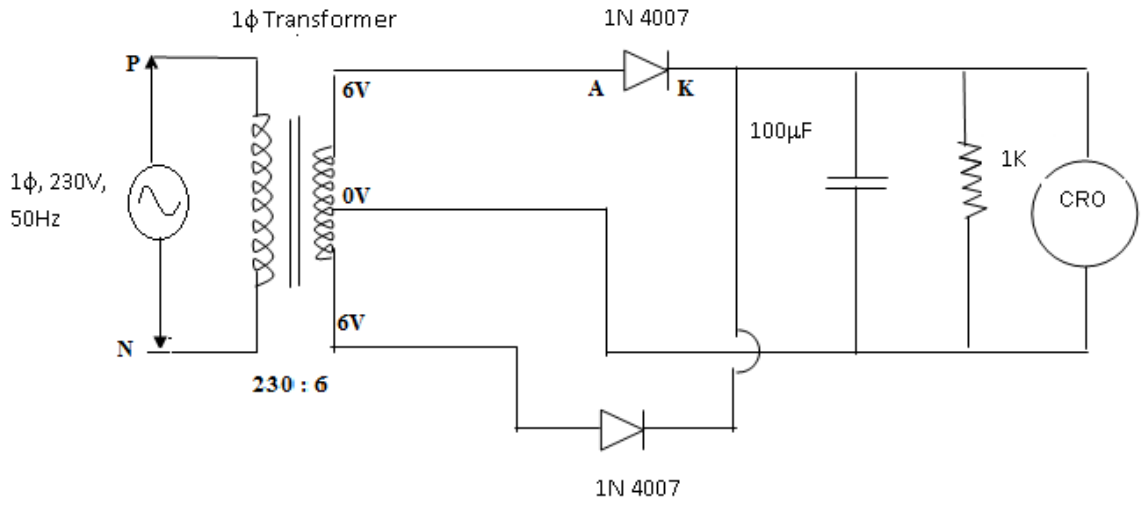
Without Filter

1. Give the connections as per the circuit diagram.
2. Give 230v, 50HZ I/P to the step down TFR where secondary connected to the Rectifier I/P.
3. Take the rectifier output across the Load.
4. Plot its performance graph.

With Filter

1. Give the connections as per the circuit diagram.
2. Give 230v, 50HZ I/P to the step down TFR where secondary connected to the Rectifier I/P.
3. Connect the Capacitor across the Load.
4. Take the rectifier output across the Load.
5. Plot its performance graph.

Circuit Diagram



Tabular Column

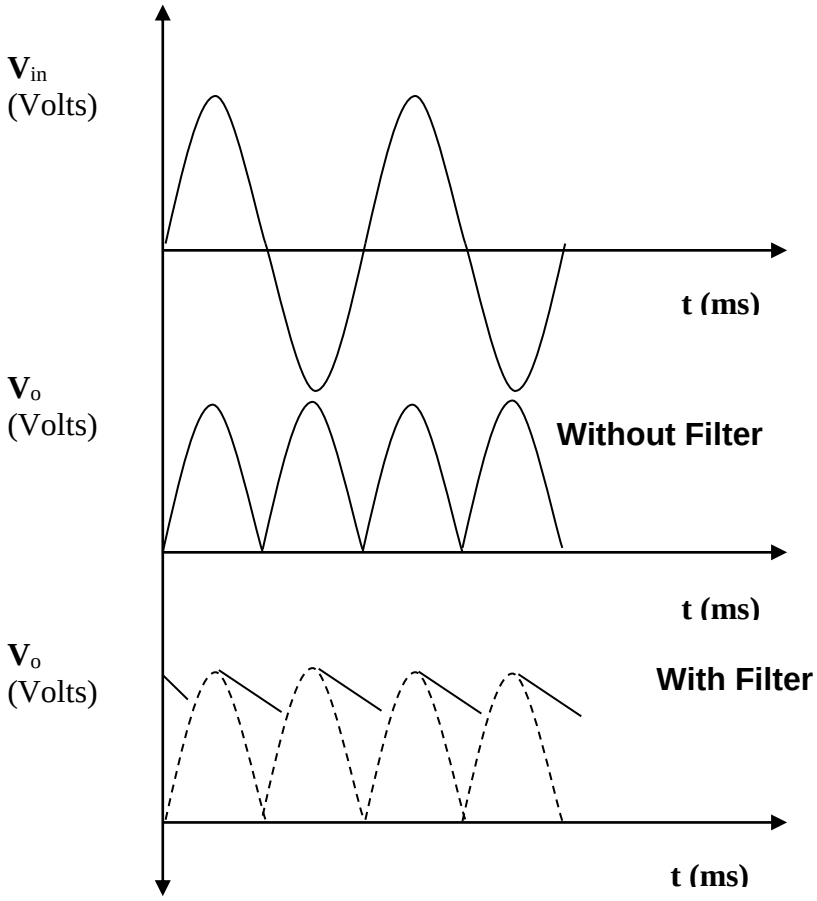
Without Filter

V_m	V_{rms}	V_{dc}	Ripple factor	Efficiency
3.67	2.595	2.336	0.483	81.034

With Filter

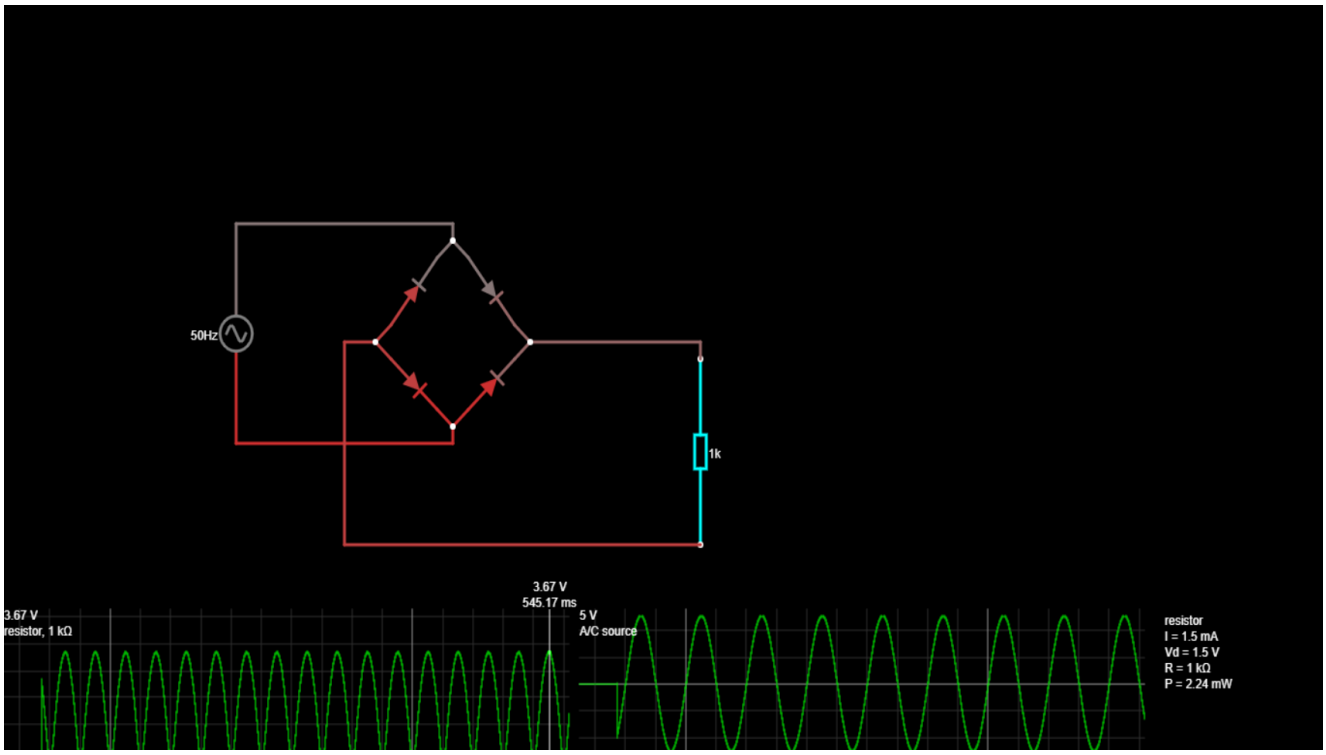
V_{rms}	V_{rpp}	V_{dc}	Ripple factor
0.080	3.62-3.34=0.28	3.39	0.023

Model Graph

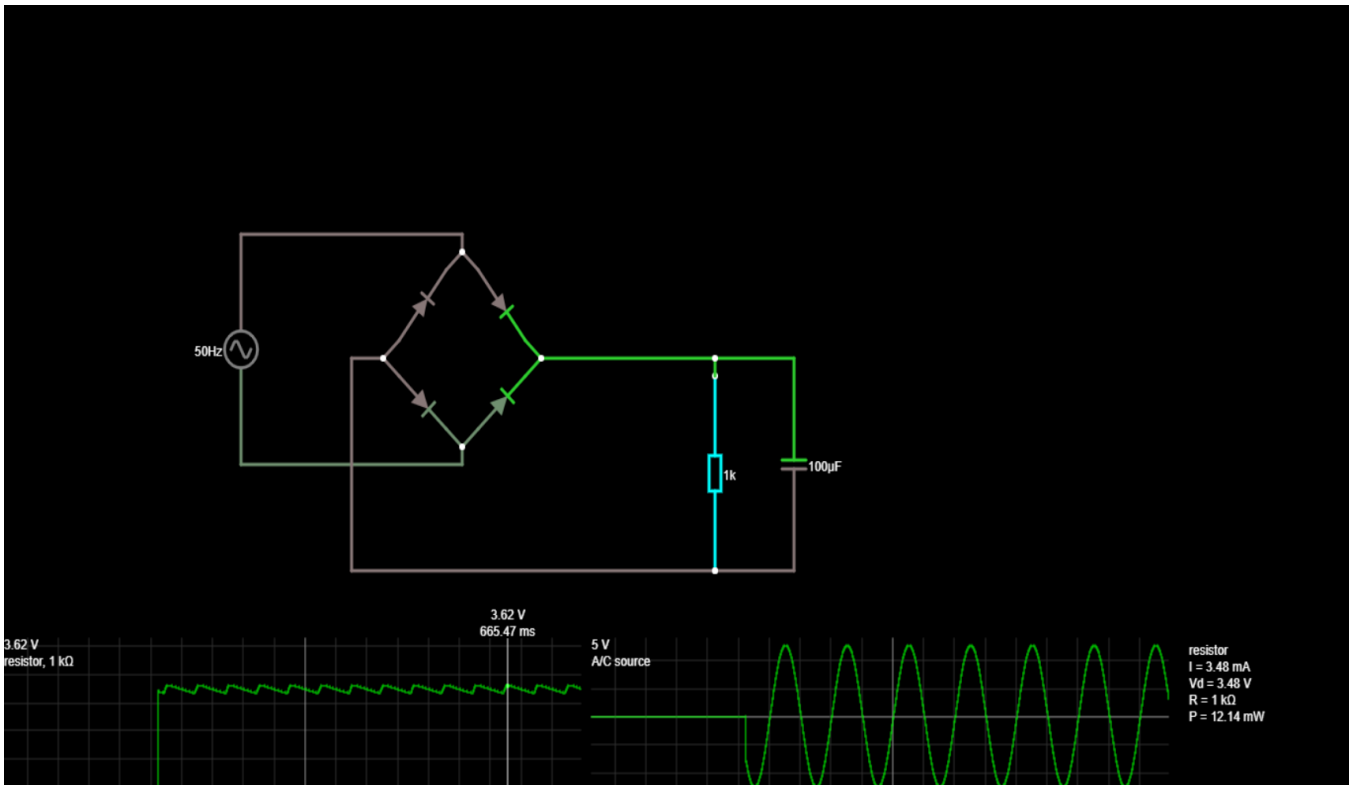


Simultion Diagram:

a) **Without filter**



b)With filter



Result :

A single phase full-wave rectifier using diode was constructed and its performance was noted in the table

POST LAB QUESTIONS

1. What is Transformer Utilization Factor (TUF)?

Answer: Transformer Utilization Factor (TUF) is defined as the ratio of DC power output of a rectifier to the effective Transformer VA rating used in the same rectifier. Effective VA Rating of transformer is the average of primary and secondary VA rating of transformer.

2. Mention the value of ripple factor for HWR, FWR & rectifier with centre tapped transformer.

Answer: The ripple factor of a HWR is 1.21
The ripple factor of a FWR is 0.483
The ripple factor of a rectifier with centre tapped transformer is 0.48

3. What is the difference between uncontrolled rectifier and controlled rectifier? Which is advantageous and why?

Answer: An uncontrolled rectifier is a simple diode which conducts for half cycle or 180 degree of sinewave and remains cut-off for remaining 180 degrees.

In a controlled rectifier, the conduction can start at any angle in positive half cycle - namely 0 to 180 degree. Once the conduction starts (rectifier or device is fired) it cannot be turned off. During negative half cycle it gets turned off.

4. State the average and peak value of output voltage and current for full wave rectifier and half wave rectifier.

Answer: The arithmetic average of all the instantaneous values of a signal is called as its average value of rectifier.

Average Value of full wave rectifier:
Output Voltage - $V_{average} = 2V_m/\pi$
Output Current - $I_{average} = 2I_m/\pi$

Average Value of Half wave rectifier:
Output Voltage - $V_{average} = V_m/\pi$
Output Current - $I_{average} = I_m/\pi$

The RMS value of an alternating current is the equivalent DC value of an alternating or varying electrical quantity.

RMS Value of Full wave rectifier:
Output Voltage - $V_{rms} = V_m/\sqrt{2}$
Output Current - $I_{rms} = I_m/\sqrt{2}$

RMS Value of Half wave rectifier:
Output Voltage - $V_{rms} = V_m/2$
Output Current - $I_{rms} = I_m/2$

5. What is PIV of a diode in half wave and full wave rectifier?

Answer: Peak Inverse Voltage (PIV) is **the maximum voltage that the diode can withstand during reverse bias condition**. If a voltage is applied more than the PIV, the diode will be destroyed.