

Experiment - 4

Half Wave Rectifier

Aim - To study half wave rectification

Apparatus - Oscilloscope, connecting wires, resistors, diode, AC supply,

Theory

Rectifier is a device that converts AC to DC, process known as rectification

Half Wave Rectification

On the positive cycle diode is forward biased and on negative cycle diode is reverse biased. Using diode, AC source is converted into a DC source. Half wave rectifier is a circuit that allows only part of an input signal to pass and single diode is in series with resistor (load).

↳ For positive half cycle -
Acts as a short circuit -

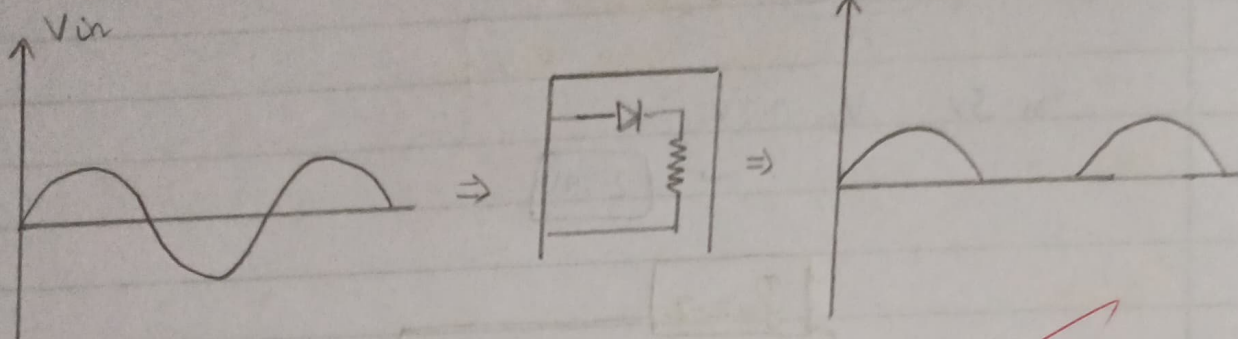
$$V_I - V_b - I \times r_d + I \times R = 0$$

Input
voltage

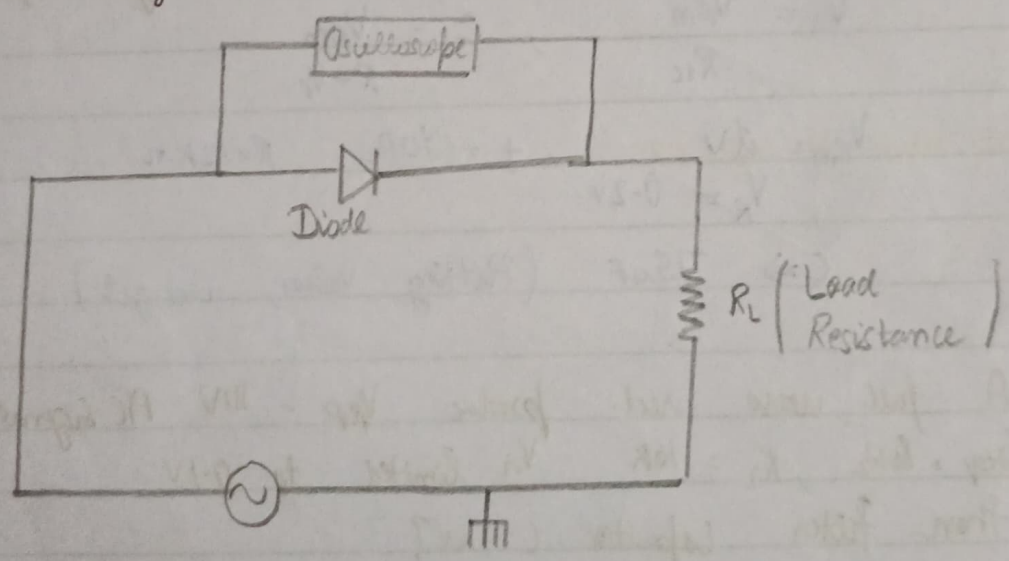
Barrier
Voltage

diode
resistance

→ Diagrams



↳ Circuit Diagram



$$V_o = I \times R = V_I = \frac{V_o}{r_o + R} \times R$$

$$V_o = V_i - V_b$$

↳ for negative half cycle
Acts as ~~open~~ circuit

$$V_o = 0 \text{ V since } I = 0$$

$$\text{Average output voltage} = \frac{V_m}{\pi} = 0.318 V_m$$

$$\text{RMS Voltage Load} = \frac{V_m}{2}$$

↳ Peak Inverse Voltage

It is the max value of reverse voltage which occurs at peak of input cycle when diode is reverse biased.

$$PIV = V$$

$$-V_m + V = 0 \Rightarrow V = V_m ; PIV \geq V_m$$

↳ Precautions

- 1) Ensure proper grounding
- 2) Observe ripple, ensure oscilloscope is sensitive enough to detect ripple voltage
- 3) Avoid overheating

Observation Table

(a) Set 1

freq = 3000 Hz

$R_L = 100 \Omega$

(b) Set 2

freq = 3000 Hz

$R_L = 200 \Omega$

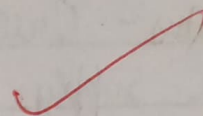
(c) Set 3

freq = 3000 Hz

$R_L = 300 \Omega$

(A)

S.No	Amp (V)	Peak Current (mA)
1	0	-6.99
2	0.5	-2.00
3	1	1.99
4	1.5	6.99
5	2	12.99



(B)

S.No	Amp (V)	Peak Current (mA)
1	0	-3.99
2	0.5	-1.00
3	1	1.48
4	1.5	3.99
5	2	5.99

Calculations

Form factor (F.F.)

$$\hookrightarrow \frac{V_{rms}}{V_{avg}}$$

$$\hookrightarrow \frac{V_{m/2}}{V_{av/2}} \Rightarrow \frac{\pi}{2} = \boxed{1.57}$$

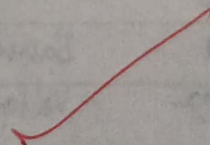
Ripple factor

$$\delta = \sqrt{(F.F.)^2 - 1} \times 100\%$$

$$\hookrightarrow \boxed{1.21\%}$$

(C)

S.No	Amp (V)	Peak Current (mA)
1	0	-2.33
2	0.5	-0.66
3	1	0.99
4	1.5	2.33
5	2	4.33

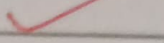


Experiment :

Date _____

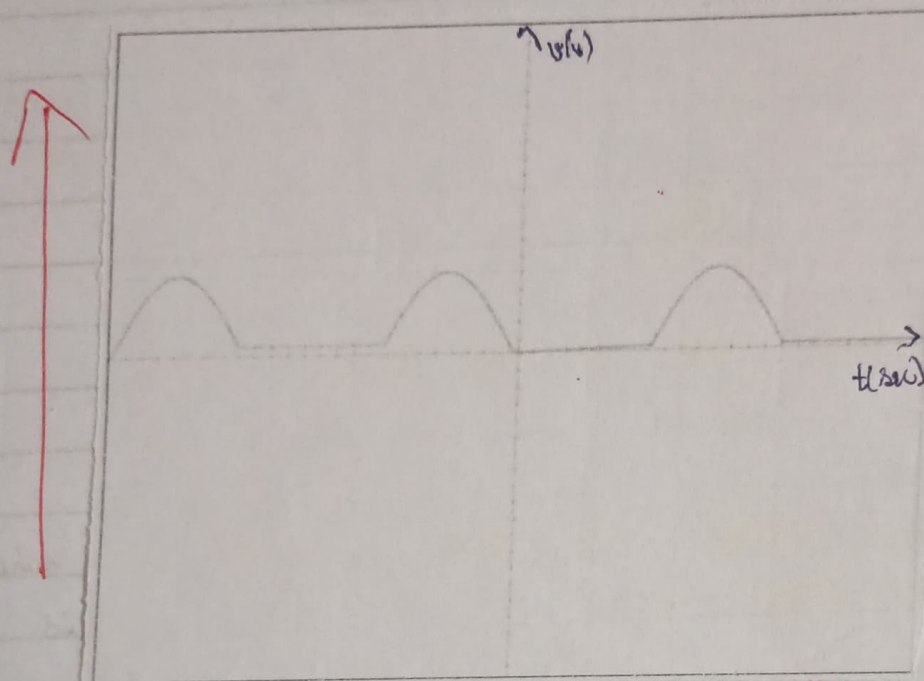
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↳ Conclusion

In half wave rectifier exp, AC converts into pulsating DC output. Only one half of AC cycle is utilized while the other ~~half~~ is blocked by diode resulting in  significant amount of ripple in output.

Graph

Half Wave Rectification



Rectified
Output DC
(frequency)

freq \rightarrow 3000 Hz

$R_L \rightarrow$ 200 Ω

(Load
resistance)

Amp = 1.5V

(Amplitude)

Channel -2 \rightarrow ?

Oscilloscope Least Count = 0.01V (for voltage)
= 1ms (for time)