Lab Report: Half-Wave Rectifier Experiment

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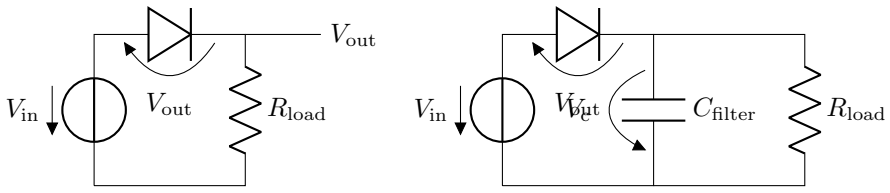
Aim

To buid a Half Wave Rectifier

Apparatus

- AC power supply
- Diode
- Resistor ($R_{\text{load}} = 1\,\text{k}\Omega$)
- Capacitor ($C_{\text{filter}} = 1\,\mu F$) [Filter]
- Oscilloscope
- Multimeter
- Connecting wires

Circuit Diagrams



(a) With Filter Capacitor (b) Without Filter Capacitor

Figure 1: Half-Wave Rectifier Circuit Diagrams

Theory

1. A half-wave rectifier is a simple electronic circuit that converts alternating current (AC) to direct current (DC).
2. The basic principle behind a half-wave rectifier is to allow only one half-cycle of the AC waveform to pass through, resulting in a pulsating DC output.
3. During the positive half-cycle of the AC input voltage, the diode conducts and allows current to flow through the load.
4. However, during the negative half-cycle, the diode blocks the current, resulting in no output.

Procedure

1. Set up the circuit as shown in Figure **??** or Figure **??**.
2. Connect the oscilloscope to measure the input and output waveforms.
3. Gradually increase the AC voltage and record the readings.
4. Measure the output DC voltage and ripple using a multimeter.

Calculation

Output Voltage Calculation

The output voltage (V_{out}) of the half-wave rectifier can be calculated using the formula mentioned in the theory section:

$$\begin{aligned} V_{\text{out}} &= V_{\text{max}} \cdot \frac{T}{2\pi} \cdot \left(1 - \cos\left(\frac{2\pi t}{T}\right)\right) \\ &= \\ &= \end{aligned} \tag{1}$$

Where:

V_{max} : Peak value of the AC input voltage
T : Period of the AC input waveform
t : Time

Average Output Voltage

The average output voltage (V_{avg}) can be calculated by integrating V_{out} over one complete cycle and dividing by the period T:

$$\begin{aligned} V_{\text{avg}} &= \frac{1}{T} \int_0^T V_{\text{out}}\, dt \\ &= \\ &= \end{aligned} \tag{2}$$

[Include the integration steps and final result.]

Ripple Factor

The ripple factor (γ) is a measure of the AC component in the rectified output and can be calculated using the formula:

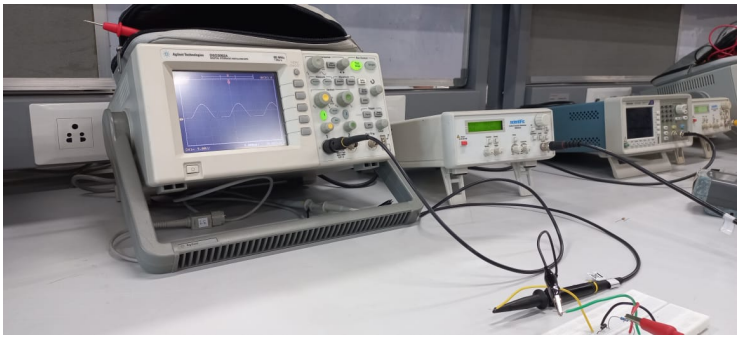
$$\begin{aligned} \gamma &= \frac{\sqrt{\frac{1}{T} \int_0^T (V_{\text{out}} - V_{\text{avg}})^2\, dt}}{V_{\text{avg}}} \\ &= \\ &= \end{aligned} \tag{3}$$

Observations

During the experiment, the following observations were made:

1. **Input Voltage (V_{in}):**
2. **Output Voltage (V_{out}):**
3. **Ripple Voltage:**
4. **Filter Capacitor Voltage (V_{c}):**
5. **Load Resistor Voltage (V_{load}):**

Lab Status



Conclusion

In conclusion, the half-wave rectifier is a fundamental circuit for converting AC to DC. While simple and cost-effective, its limitations in efficiency and output quality make it suitable for specific low-power applications