# Experiment No.3

# Center-Tapped Full-Wave Rectifier

## 1. Objectives:

- Construct the center-tapped full-wave rectifier circuit.
- Measure/plot the input and output waveform.
- Find the peak and average values of the output signal

## 2. Components and equipment

- A center-tapped transformer
- An two-channel Oscilloscope.
- An AVO meter
- Breadboard, two semiconductor Diodes, and 1KΩ Resistor.

## 3. Theory

The circuit of a center-tapped full wave rectifier uses two diodes $D_1$ and $D_2$. During the positive half cycle of secondary voltage, the diode D1 is forward-biased, and $D_2$ is reverse-biased. Therefore, the diode $D_1$ conducts, and current flows through load resistor $R_L$, as shown in Fig. 1.

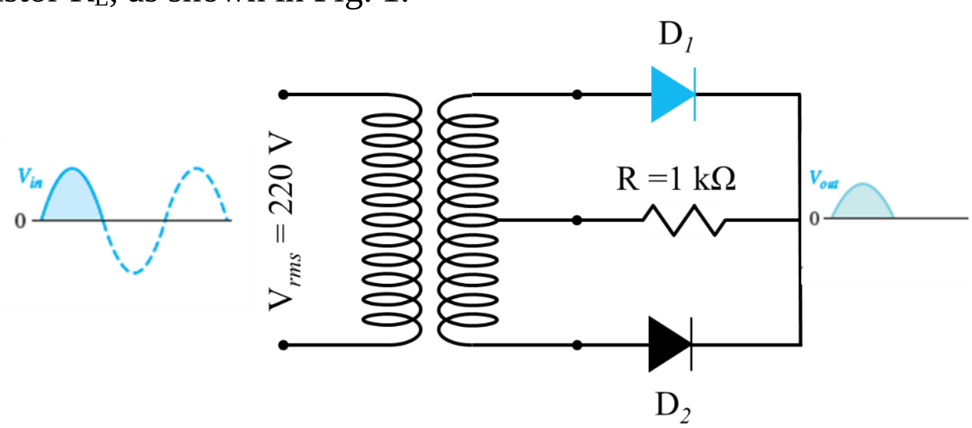


Figure 1: During positive half-cycles, $D_1$ is forward-biased, and $D_2$ is reverse-biased.

During the negative half cycle, diode $D_2$ becomes forward-biased and $D_1$ reverse-biased. In this case, $D_2$ conducts, and current flows through the load resistor $R_L$ in the same direction.

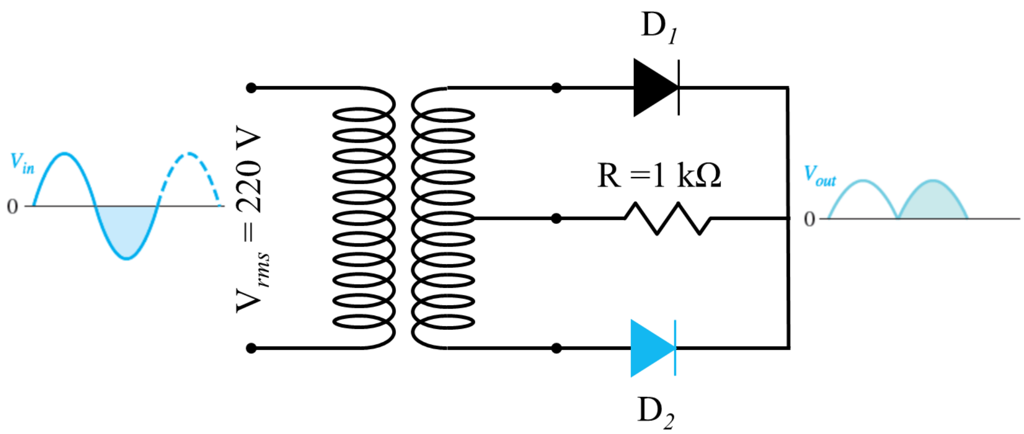


Figure 2: During negative half-cycles, D2 is forward-biased and D1 is reverse-biased.

During both half cycles, there is a continuous current flow through the load resistor $R_L$, and it will get a unidirectional current, as shown in Fig. 3. The difference between full-wave and half-wave rectification is that a full-wave rectifier allows unidirectional current to the load during the entire 2π of the input signal. In contrast, a half-wave rectifier allows this only during one-half cycle π.

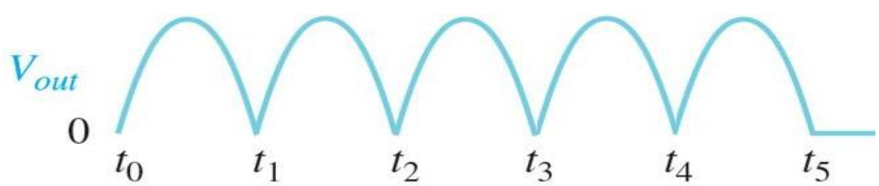


Figure 3: Fig. Output of a full-wave rectifier

## Average Value of the Output Voltage

The average value of a full-wave rectified output voltage is the value you would measure on a DC voltmeter. It can be calculated with the following equation, where $V_{p(out)}$ is the peak value of the full-wave rectified output voltage:

$$V_{AVG} = \frac{2V_{p(out)}}{\pi}$$

## 4. Experiment procedure

1. Connect the circuit as shown in Fig. 1 using a center-tapped transformer, two diodes, a 1kΩ resistor ($R_L$)
2. Connect the primary winding to the 220 V and a frequency of 50 Hz.
3. Display the input and output signal on the oscilloscope.
4. Measure the $V_{p.p}$, $V_{max}$, $V_{rms}$, $V_{AVG}$, and frequency of the input signal.
5. Measure the $V_{p.p}$, $V_{max}$, $V_{rms}$, $V_{AVG}$, and frequency of the output signal.
6. Draw the input and output signal
7. Find the turns ratio (*n*) of the transformer
8. Tabulate your measurement results in a table as shown.

| **Input Signal (FWR) across sec. winding** | **Output Signal ($R_L$)** |
|---|---|
| $V_{rms}$ = | $V_{rms}$ = |
| $V_{p(out)}$ = | $V_p$ = |
| $V_{p(sec)}$ = | $V_{p.p}$ = |
| $V_{AVG}$ = (Exp.) | $V_{AVG}$ = (Exp.) |
| $V_{AVG}$ = (Theo.) | $V_{AVG}$ = (Theo.) |
| $f$ = | $f$ = |
| Draw the input signal | Draw the output signal |
| Find the turns ratio (*n*) of the transformer. | |

## 5. Discussion

1. Is the transformer step-down or step-up? Why?
2. On a graphic paper, draw the input and output signals, both on one chart (on top of each other). Indicating the voltages ($V_p$, $V_{rms}$, and $V_{AVG}$).
3. What would be the output at $R_L$ if we exchange $D_1$ by $R_L$?